JPRS-UMS-87-008
30 SEPTEMBER 1987

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

Science & Technology

USSR: Materials Science

JPRS-UMS-87-008

30 SEPTEMBER 1987

SCIENCE & TECHNOLOGY

USSR: MATERIALS SCIENCE

CONTENTS

COATINGS

COMPOSITE MATERIALS

FERROUS METALS

UDC 669.187.2:621.365.01

THEORETICAL DETERMINATION OF OPTIMUM CONDITIONS FOR EVAPORATION OF IMPURITIES FROM METALS DURING ELECTRON-BEAM SMELTING

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 5, Jul-Aug 86 (manuscript received 18 Dec 84) pp 42-45

[Article by S. V. Ladokhin and Yu. V. Kornyushin, Kiev]

[Abstract] Evaporation of impurities from a metal during electron-beam smelting is analyzed theoretically on the basis of a physical model with two limiting parameters, total area and mean temperature of the metal pool surface, and the evaporation rate per unit surface area as variable. Taken into account is the temperature dependence of the evaporation rate and also that the nonsteady refining process is much more intense within the focal spot of the impinging electron beam than everywhere else at the pool surface, Calculations for three basically different modes of smelting and refining, namely with respectively slow, fast, and very fast scanning of the pool surface by the electron beam, yield the optimum radius of the focal spot and the optimum heat transfer conditions for maximum impurity evaporation rate. Numerical calculations on the basis of this model have been made for refining a zirconium melt by vaporization of Al, Ti, Cr, Fe and Ni impurities, indicating the depenence of the optimum radius of the focal spot for each impurity in this case on both the electron beam power at a scanning speed of 10 m/s and on the scanning speed at an electron beam power of 100 kW. References 6: 5 Russian, 1 Western (in Russian translation).

2415/5915
CSO: 1842/256

UDC 669.017.13:669.24

PHASE CONSTITUTION OF CAST Ni-Al-W ALLOYS

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 7 Sep 84) pp 104-108

[Article by M. B. Novikova and P. V. Budberg, Moscow]

[Abstract] A study covering the Ni+ (0-40 atom.% Al)+ (0-40 atom.% W) region of the Ni-Al-W system during the crystallization process was made, with inclusion of NiAl-W and Ni-NiAl-W sections of the ternary constitution diagram.

The cooling rate, calculated theoretically and on the basis of measured interdendritic distances, was 10 K/s for 1.5 kg ingots of low-tungsten alloys from an induction furnace and 10^2-10^3 K/s for 20 g ingots of high-tungsten alloys from a pot furnace. Theoretical analysis of reactions involving the liquid phase, differential thermal analysis, and experimental data, results of microstructural examination with x-ray phase and spectral analysis, have yielded the liquidus surface and isothermal constitution diagrams covering the temperature range from the end of solidification (1350°C) to the beginning of solid-state phase transformations (1000°C). One pertitectic three-phase monovariant reaction $L+\beta\rightarrow\gamma'$ (1395°C) and one eutectic three-phase monovariant reaction $L\rightarrow\gamma+\gamma'$ (1385°C) are identified in the Ni-Al section. One eutectic three-phase monovariant reaction $L\rightarrow\gamma+\alpha$ (1500°C) is identified in the Ni-W section and one eutectic three-phase monovariant reaction $L\rightarrow\beta+\alpha$ (1600°C) is identified in the NiAl-W section. In the Ni-NiAl-W section one eutectic three-phase monovariant reaction $L\rightarrow\alpha+\gamma'$ and two four-phase nonvariant reactions are identified: Class II reaction $L+\beta\rightarrow\alpha+\gamma'$ (1380°C) and Class I reaction $L\rightarrow\alpha+\gamma+\gamma'$ (1350°C). References 6: 4 Russian, 2 Western.

2415/5915
CSO: 1842/256

UDC 548.33:621.762

X-RAY ANALYSIS OF THE PHASE TEXTURE IN POLYCRYSTALLINE SUPERHARD BORON NITRIDE MATERIALS

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 2 Jul 85) pp 9-11

[Article by A. V. Kurdyumov, Institute of Material Science Problems, Ukrainian Academy of Sciences, Kiev, and V. A. Pesin, All-Union Scientific Research Institute of Abrasives and Grinding (VNIIASh, Leningrad)]

[Abstract] A method for analyzing the texture of both of the solid modifications of boron nitride in two-phase polycrystals was tested on a two-phase hexanite-P-type material. Single-phase specimens of boron nitride made by compacting powder at room temperature were also studied. Oblique x-rays were taken of cylindrical microsections that ran parallel to the end face and the outline of the compacts. The angle from which the x-rays were taken varied from 0° to 80° at 10° increments. The x-rays were taken on a DRON-2.0 diffractometer using a GP-2 attachment under CuK_α radiation. The experimental data were incorporated into empirical functions in order to derive texturegrams. By comparing an experimental texturegram with texturegrams of the materials being studied, it was possible to differentiate the intensities of texturegram lines superimposed on one another, and thereby analyze structural formation and phase transformations in boron nitride materials sintered at high pressures and temperatures. References 5: all Russian.

13050/5915
CSO: 1842/5

UDC 620.181.4:541.127:621.921.39

THERMOGRAPHIC AND X-RAY STUDIES OF THE PROPERTIES OF DIAMONDS PRODUCED THROUGH DETONATION SYNTHESIS

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 10 Sep 85) pp 11-14

[Article by A. V. Ananyin, O. N. Breusov, V. N. Drobyshev, G. Ye. Ivanchikhina, A. I. Rogacheva, V. F. Tatsiy and I. G. Shunina, Department of Physical Chemistry Institute, USSR Academy of Sciences, Chernogolovka, Moscow Oblast]

[Abstract] An effort was made to systematically study the influence of pressure and temperature during detonation synthesis on the thermooxidation resistance, substructure, and specific surface of the diamonds thus obtained. Eight specimens synthesized from PM15TS-grade butyric furnace black at various pressures and temperatures were studied. Pressures and temperatures were controlled by making discrete adjustments in the composition of the charge mixture. The specimens took the form of sub-micropowders. Thermooxidation resistance was studied using the micro-DTA method, and the BET method for krypton adsorption was used to determine specific surface. X-ray analysis of the substructure was done on a DRON-2 diffractometer, using copper-filtered radiation. The goniometer turned at one-fourth of a degree per minute. ASM 2/1-grade diamond micropowder was used as the standard. The broadening of the diffraction lines was measured through the harmonic analysis of the shape of the x-ray lines, and was used to determine the size of the coherent dispersion areas and the microdistortion of the crystalline lattice. The Williamson-Smollman equation was used to calculate dislocation density. It was found that there is a specific region of pressures and temperatures within which less refined diamonds that are more vulnerable to oxidation are formed. This region corresponds to the maximum degree for transforming black into diamonds and to the smallest coherent dispersion areas. References 7: 6 Russian, 1 Western (in Russian translation)

13050/5915
CSO: 1842/5

UDC 622.24.051

CALCULATING THE PLACEMENT DIAGRAM FOR THE SUPERHARD ROCK-PULVERIZING ELEMENTS ON THE WORKING SURFACE OF A DRILLING TOOL

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 12 Aug 85) pp 33-37

[Article by E. D. Sklyarov, Superhard Materials Institute, Ukrainian Academy of Sciences, Kiev]

[Abstract] A method was proposed for calculating, with or without the aid of a computer, the length of the cutting line or of the contact line taken over the rock-pulverizing elements in any cross-section of a boring tool, for

determining the function for the concentration of pulverizing elements over the form of the bit or the bottom of the borehole, and the function for spacing the pulverizing elements depending on the given engagement factor for the borehole bottom. This method basically entails determining the average value for the length of the contact line on a segment of the form, and allows the use of the correlation that determines the engagement factor as the basic expression for making the calculations needed when designing a tool according to a specific function for the concentration of pulverizing elements. When calculating the placement diagram, an integral engagement factor is used to factor in all of the drilling constraints. This method was shown to be effective in improving the design of the working surface, raising the technical and economic indicators for deep borehole drilling, and saving 20% to 30% on scarce raw diamonds. References 5: all Russian.

13050/5915
CSO: 1842/5

UDC 620.179.16

PROCESSING ACOUSTICAL EMISSION SIGNALS WHEN TESTING SPECIMENS MADE OF SUPERHARD MATERIALS

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 11 Mar 85) pp 40-44

[Article by S. F. Filonenko, N. I. Gorodyskiy, A. V. Shcherbakov and V. S. Biryukov, Superhard Materials Institute, Ukrainian Academy of Sciences, Kiev]

[Abstract] A system for recording and processing acoustical emission signals was developed. The system consists of an IVK-2 computer complex based on an SM-4 mini-computer. The system can be used to measure instantaneous values for a current level of monitored acoustical signals with a digitization frequency on the order of 70 KHz and can record them directly onto magnetic disk. All signal amplifications and distortions can be recorded and displayed in visual form. All signals lasting more than several tens of microseconds can be recorded in a form that is visually accessible and that can reproduce the original signal at the exit end of the detector. The digitization frequency is constant. The sensitivity threshold substantially affected the quantitative variables for the recorded signals, although this effect was ambiguous. The time intervals between the signals ranged widely from tens of microseconds to tens of seconds; therefore, the constant time of the recording apparatus could have affected the quantitative variables of the signals. Both single pulses and isolated pulse groups within a range of 10 microseconds to constant time to 10 milliseconds were detected. The concepts of "event" and "silence zone" were introduced in order to facilitate the interpretation of the acoustical data in terms of the flaws present in the materials being tested.

13050/5915
CSO: 1842/5

UDC 621.762.1

DEPOSITION OF Mo_2C ON DIAMOND SURFACE BY ELECTROLYSIS OF IONIC MELT

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 20 Sep 85) pp 43-45

[Article by V. I. Shapoval, Kh. B. Kushkhov, V. V. Malyshev, V. T. Vesna and V. P. Maslov, General and Inorganic Chemistry Institute, UkSSR Academy of Sciences]

[Abstract] Electrochemical deposition of Mo_2C coatings on diamond grinding wheels from an ionic melt was studied for comparison with deposition from gaseous Mo halides or from surface-oxidized metallic Mo powder. Diamond grains were immersed in an equimolar K_2WO_4 + Na_2WO_4 melt containing also MoO_3 and Li_2CO_3. The temperature during electrolysis was varied over the 800-900°C range, sufficiently high to ensure metallization of the diamond surface and avoid precipitation of carbide powder. The cathodic current density at the grain surface was varied over the 10-100 A/m^2 range, sufficiently high to make the diamond surface electrically conductive and thus an active substrate. The metallization level was measured by weighing, the coating thickness and phase composition were determined in a DRON-2.0 x-ray diffractometer. The deposition rate was found to depend strongly on both temperature and current density, increasing with an increase of either within a fixed duration of the process. The quality of coatings was determined on the basis of appearance and mechanical properties, tensile tests having been performed in an IMASH 20-75 machine equipped with a microscope and crushing tests having been performed with plates made of polycrystalline diamond. Coatings deposited electrolytically on As-32 500/400 and ASK 125/100 diamonds in the form of light-gray solid fine-crystalline deposits were found to improve the performance of wheels by a factor of 1.5-2.0 in grinding optical glass and thus correspondingly improve the economy of scarce precious material. References 6: all Russian.

2415/5915
CSO: 1842/259

UDC 621.396.69

FORMATION OF SiC COATING IN HIGH-FREQUENCY DISCHARGE

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 5 Nov 85) pp 46-48

[Article by V. A. Lavrenko, A. A. Chekhovskiy, A. P. Pomytkin and L. V. Strashinskaya, Kiev Polytechnical Institute]

[Abstract] Formation of SiC coatings on refractory metals from CH_3SiCl_3 in a high-frequency glow discharge was studied, with the temperature of substrates lower than during deposition from the gaseous phase by pyrolysis. The apparatus for this experiment included a quartz-tube reactor with two regulating valves for admission of CH_3SiCl_3 vapor and H_2 respectively, two rotameters, a manometer and an inductance coil around the tube energized by a 250 kW - 7.3 MHz oscillator. While the reaction byproducts were being frozen in a trap inside a Dewar flask with liquid nitrogen, SiC was precipitating on a helical tungsten wire 1 mm in diameter heated electrically from a d.c. source. The temperature of the wire, measured with a Chromel-Alumel thermocouple, was varied over the 650-750°C range and the pressure of the $CH_3SiCl_3 + H_2 = 1:2$ mixture was varied over the 13.33-133.22 Pa range. For comparison, SiC coatings were also deposited by pyrolysis of CH_3SiCl_3 at 1200°C. Examination of the coating surface under an electron microscope with 2-stage carbon-plastic replicas preshadowed with Cr revealed a characteristic acicular-lamellar structure with almost perfect crystals. Petrographical analysis under an MIN-7 microscope on the basis of refractive indexes revealed structural differences between SiC coating deposited by pyrolysis and in high-frequency discharge respectively, with the cubic β-SiC phase predominant in the former and the hexagonal α-SiC phase predominant in the latter. The results of radiospectroscopic qualitative analysis for determination of free radicals or atoms formed by dissociation reactions and limiting the deposition process indicate a breakaway of Cl atoms from the CH_3SiCl_3 molecule in a high-frequency discharge, then a recombination of CH_3Si^* with dissociated H atoms, and then a decomposition reaction $CH_3SiH_3 \rightarrow SiC + 3H_2$, with HCl as byproduct. References 11: 6 Russian, 5 Western (1 in Russian translation).

2415/5915
CSO: 1842/259

UDC 621.762

FRICTION CHARACTERISTICS OF COMPOSITE MATERIALS WITH MACROSCOPICALLY OR MICROSCOPICALLY HETEROGENEOUS WORKING SURFACE

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 7 May 85) pp 78-83

[Article by L. F. Kolesnichenko, A. I. Yuga, T. M. Chevychelova and I. N. Tupitsyn, Institute of Materials Science Problems, UkSSR Academy of Sciences]

[Abstract] The friction characteristics of Fe-brass composite materials with macroheterogeneous or microheterogeneous working surface were studied, 60% Fe - 40% L80 brass (80% Cu + 20% Zn) having been selected as representative material. A macroheterogeneous surface was produced by milling 1 mm wide and 5 mm deep grooves in a cylinder of St45 carbon steel and filling them with brass melt, these grooves being spaced so as to ensure a 60:40 iron-to-brass area ratio. A microheterogeneous structure was produced by adding 40% brass powder of the 160-250 μm grain (aspherical) size fraction to an Fe-alloy (steel) powder base so as to form a homogeneous mixture. Friction tests were performed in an MTVK-75 machine under vacuum (residual pressure $2.66 \cdot 10^{-3}$ Pa) and in an M-22M machine in air with a sprinkle of distilled water, against St45 carbon steel (Rockwell C 48-50 hardness) or St20 carbon steel with the sliding velocity varied over the 0.5-1 m/s range and the load pressure varied over the 1-10 MPa range. The friction coefficient of the pair as well as the wear rate of the composite material and wear rate of the abradant were measured, whereupon microhardness was measured with a PMT-3 tester. Microstructural examination was done under an MIM-8 optical microscope and under an REM-200 scanning electron microscope. The results indicate that the hard Fe component ensures adequate wear resistance and the soft brass component forms a shielding antifrictional film, the microheterogeneous material having better characteristics than the macroheterogeneous one. Tests performed on specimens with the L80 brass content varied over the 10-60% range have confirmed that 40% L80 brass yields the optimum friction and wear characteristics. References 9: all Russian.

2415/5915
CSO: 1842/259

UDC 621.762

DEPENDENCE OF MECHANICAL PROPERTIES OF BRONZE-FERROCHROMIUM COMPOSITE MATERIAL ON FERROCHROMIUM CONTENT AND ON PRODUCTION METHOD

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 20 Oct 85) pp 86-90

[Article by R. M. Askarov, N. P. Brodnikovskiy, V. A. Pisarenko and L. I. Tuchinskiy, Institute of Materials Sciences Problems, UkSSR Academy of Sciences]

[Abstract] Mechanical strength and tribomechanical properties of composite antifriction materials, BrO Sn-bronze base + (3,5,8,10%) Fe-Cr-C, were measured for the purpose of correlating these characteristics with the Fe-Cr-C content and with the sintering conditions while also comparing them with those of pure BrO bronze. Tensile strength and compressive strength were measured respectively on flat and cylindrical specimens in a 123I10 universal machine, microhardness was measured with a PMT-3 tester and toughness was measured in a KM-5 impact machine. The mode of fracture was determined under a JSM-20 scanning electron microscope. Friction and wear tests were performed in an M-22 PV machine with spindle oil as lubricant against St45 carbon steel (Rockwell C 42-45 hardness) at a sliding velocity of 1 m/s under a load pressure of 7 MPa. Mechanical strength was found to be particularly sensitive to porosity throughout the process, a low final porosity but an initially high porosity dropping not below 25-30% during compaction and sintering ensuring better and more stable mechanical properties. While microhardness before friction tests and strength increased but toughness decreased with increasing Fe-Cr-C content, monotonically, a change of the trend was found to occur within the 4-6% Fe-Cr-C range (strength tending to saturate, toughness dropping steeply from high to low level, microhardness after friction tests dipping to a sharp minimum at approximately 5% Fe-Cr-C and then increasing more steeply) probably caused by a change of bronze-ferrochromium interaction mode under load and also affecting the tribomechanical properties. References 5: all Russian.

2415/5915
CSO: 1842/259

FERROSILICON FROM YERMAK AWARDED PRIZE

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 2 Aug 86 p 1

[Article by Correspondent V. Stupak: "The Best in the World is Made in Yermak"].

[Text] Yesterday congratulations were sent from Moscow to Yermak. The International Trade Chamber in Luxemburg had recognized "Ferrosilitsiy-45" [Ferrosilicon-45] as the best iron alloy in the world. It was awarded a special prize. This is the first time such an honor was awarded to a Soviet alloy.

"Every year we export about 100,000 tons of alloys of various types," said the Chief Engineer of the Yermak Iron Alloy Plant, Yuriy Yakovlevich Kashayev. "They all enjoy a good reputation. But Ferrosilitsy-45 is our special pride. All the services have been striving to support a stable chemical makeup of the metal over the course of many years. And the main element in it is silicon. This is achieved by exacting management of the process using a control system, and these are operated by masters of their craft. We have several such people.

Now Yermak is supplying the domestic market and almost two dozen other countries with three types of ferrosilicon and ferrochrome and various steels. And after reconstruction is completed in several shops and auxiliary services, high-quality metal will be delivered in even greater volumes.

9016
CSO: 1842/1

STEEL INDUSTRY PROSPECTS, RESTRUCTURING DISCUSSED

Moscow PRAVDA in Russian 26 Aug 86 p 1

[Article: "Metallurgy -- Precise Rhythm"]

[Text] Ferrous metallurgy in truth is called the foundation of industry. This branch which comprises the material basis for accelerating technical progress, to a large extent determines the economic potential of the country. Without output of high-quality metal products, it is impossible to achieve the demanded turning point in machine building, construction, and other branches of the economy.

But the metallurgical industry itself has to walk in step with the times, and very quickly renew its own basic funds. Now the branch has a program of technical re-equipping. But setting hopes only on the future, the metallurgists must remember that a great deal can be done right now using their own forces. Evidence of this can be seen in the fact that collectives who in recent years have chronically been behind schedule, such enterprises as Azovstal , Zaporozhstal , and the Oskolskiy Electrometallurgical and Novokrivorozhskiy Mining and Benefication Combines, in literally 3-4 months have been able to solve problems which had not been solved for years, and have begun to work in a stable manner.

This took place not only due to a change in managers, but for the most part thanks to an increase in the activity of the collectives and party committees in setting up order in the shops, and strengthening labor and production discipline. There are still many unsolved problems at ferrous metallurgy enterprises, but it is gratifying that they are working on reorganizing the branch not by word, but by deed.

For the first time in many years they are fulfilling the plans not only for volumes, but for decreasing costs and increasing labor productivity and profit. Along with this, in PRAVDA there continue to appear signals that several metallurgical plants and combines, in exceeding their tasks for tonnage, are violating completions of deliveries under contract. And if a plant or a construction site does not receive in time that very type of rolled steel that is called for in the contract and so had to use that which is at hand, then it is unavoidable that there will be excessive use of steel, and extra expenditures of time for processing the articles. That is why from our one hundred percent fulfillment of orders, the output of just those articles which the customers need is satisfied.

As practice at the leading enterprises has shown, the basis of rhythmic work and completion of contract obligations is the creating of economically based supplies within all technologically based limits. Such a task was placed before the metallurgists last autumn. And there where they have managed to comply with the decision, they are not letting their customers down.

There are still some plants and combines working "at the warehouse." They are filling the plan in this way, but their customers are no better off because the production is stopped at the warehouse. It is necessary to distribute the experience of the Asha Metallurgical Plant. Here the shop receives not a task for rolled steel output, but a firm schedule for shipping production to a specific customer. And a shift should not simply produce so many tons, but make them up into box-car lots, and it is to be reported not only in tons but in complete box-car lots. A great deal of experience in precise fulfillment of contracts has been amassed at the Novolipetskiy Metallurgical Combine, the standard bearer in ferrous metallurgy. The branch staff and the local party committees have to take a broad look at the achievements of the best. They have to set up matters such, so the results of the metallurgists' labors will be evaluated in the first analysis as their fulfillment of orders without any favorable percentages.

The economy of the country is holding to a course of conserving raw material, energy, work time, and other resources. For ferrous metallurgy, where the share of material, raw material, fuel and energy comprises 75 percent of costs, these tasks are especially true. Each collective has to strive to rationally decrease expenditures on each technological limit -- decreasing the specific expenditure of coke for making pig iron, of pig iron for making steel, and of steel for producing rolled steel. It will help to decrease expenditures and strengthen contacts with customers. Thus, at the Cherepovets Metallurgical Combine they have established that a number of customers now only determine the strength and size of a plate, irrespective of its weight and thickness. This means that if through special processing they can achieve the required strength, then they can produce a thinner sheet, and consequently save some resources and metal itself. Such an approach is producing huge savings, and must become a model for all the metallurgical enterprises of the country.

It is calculated that by 1990 due to tremendous growth in economical aspects of metal production and modernization of assortments, the branch will produce a savings of metal equalling 60 percent of the growth in the production of metal products for the entire Five Year Plan [FYP]. For this it is necessary to activate a search for reserves for decreasing the volume of metal in rolled steel, pipe, and metal articles and increasing their strength characteristics.

Supplying other organizations with the "bread of industry", metallurgy itself depends to a large extent on its subcontractors. Now, in a period of broad-based reconstruction, the main partner of the workers in the hot shops of the country are the machine builders. The manufacture of reliable, economical, highly productive equipment, the technical re-equipping of the branch is a task of enormous importance. Its realization must become the reason for

first-priority support of the collectives which are working on this matter, the fellows of the design bureaus, the planning and scientific research institutes, and the producers. During this the metallurgical scientists are obliged to anticipate the requirements of the machine builders.

A new form of organization of work for technical re-equipping became an experiment at the Alapaevskiy Metallurgical Plant. Its essence is that during the time of plant shutdown for reconstruction, the metallurgists would be occupied with construction-installation work to preserve the average salary (when fulfilling the standards), uninterrupted length of service, and the privileges of the smelting profession. The initiative was supported by local party and government organs. Many party committees maintain close contact with metallurgist collectives. This, the Chelyabinsk Oblast Party Committee conducted a special guest plenum in Magnitogorsk concerning questions about accelerating the combine's reconstruction. A great deal of work in accelerating the construction of ferrous metallurgy projects has been done by the party committees in the Belgorod, Lipetsk, Karaganda, Dnepropetrovsk, and other oblasts. As a result the construction workers found themselves with reserves for completing supplementary work worth tens of millions of rubles.

Now the metallurgists have to secure their changes for the better at work and give them a persistent character. The enterprises' party committees must orient the collectives toward the output of high-quality production and fulfillment of the plans for technical re-equipping. These tasks must always be at the center of attention of Communists.

Only daily shock work from metallurgists and steady, painstaking work for updating planning and organizing production, technology, and equipment will allow us to achieve the high levels which are assigned by the Five Year Plan, and to successfully complete the tasks which were assigned by the 27th Party Congress.

9016
CSO: 1842/1

UkSSR FERROUS METALLURGY TO ECONOMIZE RESOURCES

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 9, Sep 86, pp 59-63

[Article by Yu. Dolgorukov, candidate of technical sciences, Dnepropetrovsk: "Reserves for Economizing Material Resources in Ferrous Metallurgy"]

[Text] The Basic Directions of USSR Economic and Social Development for the Years 1986-1900 and For the Period Until the Year 2000 specify that: "Economization is one of the most important factors in the intensification of production and must be successively reinforced. Economization of resources must be turned into a decisive source for satisfying rising economic demands. We must achieve a situation where the growth of demand for fuel, energy, raw material and materials would be 75-80 percent satisfied by economization."

Many technical, economic and organizational factors affect the specific consumption of material resources at ferrous metallurgy enterprises. Additional reserves for the economization of material resources can be found by methods of interplant and intraplant comparative analysis. These methods can also: 1) show growth and loss trends and the reasons for these trends; 2) evaluate leading experience and 3) determine the possibilities of more efficiently using material resources and ways to realize these possibilities.

Work is being done to improve the use of material resources in the UkSSR ferrous metallurgy sector. During the 11th Five-Year Plan, the following specific consumptions were reduced: metallurgical coke, by 25.1 kg (a savings of 1,184,000 tons); pig iron for steelmaking, by 10.6 kg (a savings of 546,000 tons), and metal for rolling, by 6.8 kg (a savings of 252,000 tons). The sector made better use of ferroalloys, refractories and iron-containing production wastes. In all, over 110 million R worth of material resources were saved. However, the material-intensiveness of products is not being reduced fast enough. Several types of material resources are still being overconsumed compared with the plan norms. There are also signficant differences in the level of material consumption at different enterprises. This indicates that there are significant reserves for economizing material resources.

One of these reserves is to reduce iron losses in all metallurgical conversions. The total quantity of iron lost annually in UkSSR ferrous

metallurgy is about 25 percent of the sector's total iron resources. This quantity of iron could be used to produce metal products worth about 750 million R. Large losses of iron occur during iron-ore beneficiation. For example, the Southern Mining-Enrichment Combine [GOK] extracts 82.72 percent of the iron from the raw material, while the Novokrivorozhskiy GOK extracts only 68.7 percent.

The basic direction for increasing the yield of iron-ore concentrate at mining-enrichment combines is to further improve the iron-ore crushing and beneficiation equipment and technology. This can be accomplished by: 1) faster replacement of old equipment with improved models, 2) expanded use of two- or three-stage ore-comminution technology and 3) process automation. In order to use the enormous amounts of oxide iron ores now stored at GOK's, high-intensity magnetic separators are to be developed during the 12th Five-Year Plan. Industrial testing of ERFM-1 separators at the Central GOK was successful: the GOK has begun producing a concentrate containing 61.9 percent iron. The CEMA countries agreed to build a combine equipped with modern separators to enrich oxide ores.

The Basic Directions pose the task of increasing the output of finished rolled products with no increase in iron production and a significant decrease in coke consumption. Better-quality preparation of iron-ore materials for smelting is a reserve for economizing scarce coke and for increasing the output of iron and steel. In order to do this, existing sintering mills are to be reconstructed by the proven method of combining capital repairs with modernization and staged reconstruction.

One of the factors influencing iron output and the level of raw-material consumption is the degree of iron utilization in blast-furnace production. Ferrous metallurgy enterprises in the UkSSR have a specific iron consumption of 1035.2 kg per ton of pig iron, which is 41.9 kg higher than that for Soyuzmetallurgprom enterprises. Elimination of this difference would reduce the annual demand for iron ore by 3.0-3.2 million tons.

Analysis shows that the greatest iron losses occur in the blast-furnace dust (30-32 kg per ton of pig iron). Half of these losses occur in untrapped blast furnace dust; i.e., they are irretrievable. For Soyuzmetallurgprom enterprises, these losses are less than 11.6 kg. The main reason for the higher losses is the high content of fines (0-5 mm) in the prepared iron ore. At the Kommunarsk Metallurgical Combine, the fines content in sinter is about 10 percent, due to better preparation. Reduction of the fines content to that achieved at the Kommunarsk Combine would save 1.7 million tons of iron ore. In addition, the specific coke consumption can be reduced by 30-40 kg (saving 1.4-1.6 million tons of coke) and the productivity of blast furnaces can be increased by 4-5 percent (increasing the iron output by 1.8-2.0 million tons).

Operations at modern sintering mills of the Novolipetsk and West Siberian Metallurgical Combines and at the reconstructed No 2 sintering mill of the Novokrivorozhskiy GOK showed that sinter fines can be effectively removed by multistage sorting on vibrating screens. Among UkSSR ferrous metallurgy enterprises, two-stage screening on vibrating screens can be implemented at the sintering mills of the Zhdanov imeni Ilich, Dnepropetrovsk imeni

Dzerzhinskiy and Kommunarsk Metallurgical Combines. The sinter discharge systems in the sintering mills of the Yenakiyevo Metallurgical Plant, the Zaporozhstal Combine, the Southern GOK and the Kamysh-Burunskiy Combine should be redesigned, replacing the stationary screens with single-stage vibrating screens to remove fines.

Overall for the above enterprises, the introduction of improved screening technology will provide an increase of 670,000 tons of iron and save 325,000 tons of coke, for a total savings of 13 million R. It should be noted that the volume of sinter production will decrease by about 1.3-1.5 million tons. However, this can be compensated by implementing new charge-preparation technology. The Donetsk Scientific-Research Institute of Ferrous Metallurgy [DonNIIchermet] has developed a new charge-preparation technology involving: 1) group metering of components, 2) separate moistening and pelletizing and 3) combined mixing/moistening to bring the entire charge up to the optimum moisture content. This technology can be implemented at the Zhdanov Metallurgical Combine imeni Ilich, the Southern GOK and the Novokrivorozhskiy GOK, which would permit an additional output of about 1.6 million tons of sinter per year and save 58,000-60,000 tons of sintering fuel. The capital investments needed for reconstruction of the sintering mills will be paid back within the normative period (6-7 years).

Coke for iron smelting costs 1.7 billion R per year and represents up to 40 percent of the fuel balance for ferrous metallurgy. This indicates the importance of the problem of reducing the fuel-intensiveness of iron, especially because this has tended to increase in recent years, despite a reduction in the specific coke consumption. For example, from 1976-1985, the specific consumption of skip coke for the production of 1 ton of iron was reduced from 524.4 to 514.6 kg. However, the fuel-intensiveness of 1 ton of iron over that same period increased from 640 to 655 kg of standard fuel. The main reason for this was an increase in natural gas consumption from 90.0 m^3/t in 1976 to 110.5 m^3/t in 1985.

At present prices, it is advantageous to use natural gas instead of coke. However, fuel is becoming increasingly scarce in the European part of the country, and fields in Central Asia and Western Siberia have become the main suppliers of natural gas. Therefore, although the problem of reducing the specific coke consumption is one of the most important problems in the sector, the same serious attention must be given to improving the efficiency of natural-gas use in blast furnaces. The use of natural gas necessitates the use of enormous quantities of oxygen, the consumption of which increased from 83.9 m^3/t of iron in 1975 to 116 m^3/t in 1985. It takes 0.599 kWh of electricity to generate 1 m^3 of oxygen, and it takes 0.4121 kg of standard fuel to generate 1 kWh of electricity. In 1985, about 5 billion m^3 of oxygen was consumed, the generation of which required over 3 million kWh of electricity. Production of that quantity of electricity, in turn, required about 1.3 million tons of standard fuel.

Efficient consumption of oxygen and natural gas is an important reserve for economizing coke. The need to carefully select blast-furnace operating conditions is especially important. Coke can be economized only if the blast oxygen content is properly balanced with the natural gas consumption. The experimentally established degree of natural-gas compensation for

oxygen (0.6-0.65) is not being maintained at many enterprises: it is 0.256 at the Krivorozhstal Combine and 0.248 at the Makeyevka Metallurgical Combine, while it is 0.35 for the entire sector. Only the Yenakievo Metallurgical Plant and the Zaporozhstal Combine are close to the optimum value for this indicator.

Still, the most promising direction for economizing coke is to improve the iron-ore quality, primarily by increasing the iron content and basicity of the charge and by improving the particle-size content. A reserve for economizing coke is to improve its quality. The 12th Five-Year Plan calls for the renewal of coke ovens at coke-chemical producers, as well as for the realization of a series of measures to implement new methods of coke charge-preparation and coke production. These measures provide for an increase in the content of weakly caking coals in the charge and for an increase in the mechanical strength of coke. In conjunction with this, an experimental commercial installation for charge heat treatment is to be built and put into operation at the Donetsk Coke-Chemical Plant. If successful, this technology will be used at the Dneprodzerzhinsk, Zhdanov, Avdeyevka and Yenakievo Coke-Chemical Plants, which will heat treat over 7 million tons of charge materials; this will reduce the consumption of caking coals by 4 million tons per year. Charge heat treatment increases the coke-oven output by 30 percent. The strength of the coke is maintained while replacing 10-20 percent of the caking coals in the charge with noncaking coals.

An efficient direction for coke economization is to use pulverized coal fuel. Using this technology, which was developed by DonNIIchermet, the Donetsk Metallurgical Plant produces 75 percent of its iron while consuming less than 65.4 kg/t of coal and 78 m^3/t of natural gas, which saves over 30,000 tons of coke per year. This technology should be implemented during the 12th Five-Year Plans at the Azovstal, Zaporozhstal and Kommunarsk Combines. The use of 785,000 tons of pulverized coal per year at these enterprises will save 11 million R, while coke savings will total 800,000 tons.

The republic's ferrous metallurgical enterprises are to reduce their pig-iron consumption for steelmaking by 1.85 million tons during the 12th Five-Year Plan. The average specific pig-iron consumption for USSR Minchermet [Ministry of Ferrous Metallurgy] is 660 kg/t of steel, while for UkSSR Minchermet enterprises, it is 720.6 kg/t; i.e., over 5.0 million tons of pig iron are overconsumed per year.

There is a significant difference in the specific pig-iron consumptions of open-hearth shops. In 1985, this indicator was 543.2 kg/t at the Krivorozhstal Combine and 547.6 kg/t at the Donetsk Metallurgical Plant. In contrast, it was 626.0 and 732.9 kg/t at the Makeyevka and Azovstal Metallurgical Combines, respectively, while it averaged 606.4 kg/t sector-wide for single-bath furnaces. These variations are primarily caused by the quality of scrap metal, and in the final analysis, by the quantity of scrap used. On average, USSR Minchermet consumes 447.2 kg of scrap per ton of steel, while UkSSR Minchermet steelmaking shops consume 382.7 kg/t.

The proportion of bundled scrap during the last 10 years does not exceed 25 percent, while the proportion of oversized scrap is over 40 percent, which is a result of the low technical level of scrap-processing equipment. At present, the bulk weight of scrap is 1.0-1.04 t/m^3. Calculations show that if the average scrap density was increased to 1.2-1.4 t/m^3, the production of steel in these same steelmaking furnaces could be increased by 850-900 thousand tons with a significant reduction in pig-iron consumption. The savings would total 144 million R, while the additional expenditures for equipment replacement and reconstruction of scrap-processing facilities would be paid back within 1 year.

The costs of collecting, transporting and preparing 1 ton of scrap are 1/8 the costs of making 1 ton of pig iron. Scrap metal resources are constantly increasing, because more metal is used in the country and more is consumed in metalworking and construction. Therefore, more scrap will have to be used in steel production; without a fundamental improvement in the quality of scrap preparation, this will be impossible. The quality of scrap preparation can be improved by: replacing scrap-processing equipment, removing outmoded equipment, mechanizing manual operations, implementing progressive scrap-processing methods (shearing, crushing of pre-cooled scrap, bundling in a low-oxidizing heating medium, cold rolling of chips, plasma cutting etc.), organizing scrap processing where the scrap is produced and optimizing scrap handling and scrap-delivery systems at metallurgical enterprises. There will be further growth prospects for replacing pig iron with prepared scrap with the introduction of processes for combination steelmaking in oxygen converters using neutral gases, carbon-containing materials and scrap preheating.

In 1986-1990, the volume of steel production by combination methods should reach 33.5 million tons. The implementation of these methods will reduce pig-iron consumption by almost 1.85 million tons, saving 35 million R. The additional expenditures will be paid back in 5-6 years. For these purposes, a sector targeted program was developed, which takes into account: 1) the results of scientific research by IChM [not further identified] of USSR Minchermet, DonNIIchermet, DMeTI [Dnepropetrovsk Metallurgical Institute] and DPI [Donetsk Polytechnical Institute] of the UkSSR Ministry of Higher and Secondary Specialized Education; 2) the recommendations of project organizations (Ukrgipromez [Ukrainian State Project Institute for Metallurgical Plants], Giprostal [State Scientific-Research and Project Institute of the Metallurgical Industry] etc.) and 3) proposals from enterprises.

A new converter smelting technology developed by DonNIIchermet is to be implemented in the oxygen-converter shop of the Yeniakovo Plant. This technology involves: 1) cyclical shifting of the tuyeres, 2) scrap preheating by double pouring of pig iron and by burning all the carbon monoxide inside the converter and 3) using AS [pea size] anthracite in the charge. This series of measures will reduce the iron consumption by 42 kg/t of steel.

For successful implementation of combination methods of blowing steelmaking, the Dneprovskiy Combine imeni Dzerzhinskiy must accelerate: 1) implementation of the IChM technology for blowing in powdered lime and

increasing the bottom oxygen flow to 30 percent; 2) development of a tuyere design which can provide the maximum degree of carbon-monoxide combustion inside the converter; 3) the addition of coal to the blow and 4) the preheating of scrap with natural gas. This technology should reduce iron consumption by 115 kg/t. Combination methods must also be implemented at the Azovstal Combine in Zhdanov, the Imeni Ilich Combine, Krivorozhstal, Zaporozhstal and the Dnepropetrovsk Metallurgical Plant imeni Petrovskiy, taking into account the distinguishing features of each facility. As the proportion of scrap in the converter charge increases, the energy-intensiveness of the steel decreases, despite the use of additional fuel, natural gas and coal. When the proportion of scrap in the converter charge is increased from 27 to 50 percent, the energy-intensiveness decreases from 0.9060 to 0.7059 tons of standard fuel and approaches the energy-intensiveness of open-hearth steelmaking.

The experience of the Krivorozhstal and Zaporozhstal Combines shows that the specific iron consumption can be reduced by implementing organizational measures with insignificant additional costs. At the Krivorozhstal combine, all the mixer departments are equipped with slag pumps; the slag removed is accounted for and subtracted from the iron weight. Measures are taken to maintain the iron temperature during transport to the steelmaking shops. Coke fines are used in the charge and to adjust the carbon content during teeming. The Zaporozhstal Combine ensures that the charge is standardized. At a number of enterprises, the capacities of charging boxes and shovels are being increased and other devices are being developed to permit rapid scrap charging.

The efficient use of iron requires: 1) stabilization of its chemical content during blast-furnace smelting and 2) homogenization in mixers. One of the reserves for the efficient use of iron is to improve the durability of ingot molds. During the 11th Five-Year Plan, the consumption of molds at UkSSR ferrous metallurgy enterprises was reduced from 20.89 to 19.85 kg/t of steel. However, the specific consumption of molds remains high. There are reserves in implementing new heat-equalizing mold designs (Imeni Dzerzhinskiy, Imeni Ilich, Kommunarsk and Zaporozhstal Combines), casting more molds out of pig iron (Azovstal, Imeni Dzerzhinskiy and Kommunarsk Combines)and applying protection coatings. These measures should save over 15,000 tons of molds worth a total of 1.2 million R. There are large reserves in reducing mold consumption through improved mold service conditions. In addition, DonNIIchermet has developed a system of planning mold production in standard tonnage, which takes into account: 1) the labor-intensiveness of casting the molds and mold quality, 2) a system of mutual calculations on mold quality between shops and 3) maintaining good mold service conditions. The implementation of such systems will further reduce mold consumption.

There are reserves for economizing manganese-containing ferroalloys in steelmaking by using various ladle-treatment methods (vacuum treatment and the use of carbon-containing materials, silicocalcium, synthetic slags and inert gases), adjusting the manganese and aluminum contents of the steel in the ladle and deoxidizing steel in the ladle instead of in the furnace (thus reducing the furnace loss by 20-25 percent). When steel is deoxidized in the ladle, the efficiency of ferroalloy use mainly depends on

the solution of organizational and technical problems of preparing, handling and adding the ferroalloys. Ferroalloy manufacturers have begun crushing the ferroalloys, removing the fines (0-9mm) and supplying the ferroalloys to metallurgical enterprises in crushed form (piece sizes of 10-50 mm) in containers, thus reducing irretrievable losses by 5-7 percent. The regulated addition of ferroalloys into the ladle from metering hoppers (the practice at the Zaporozhstal Combine) makes it possible, depending on the grade of steel being made, to regulate the ferroalloy consumption and to ensure the necessary final chemical composition with minimum ferroalloy consumption. Two significant reserves for reducing ferroalloy consumption are to expand the production of continuously cast steel and to produce thermally hardened rolled steel out of carbon steel instead of low-carbon steel. The first direction will provide a 10-15 percent savings of manganese-containing ferroalloys, while the second will provide a 33-50 percent savings of these ferroalloys.

One of the most efficient measures to reduce metal scrap in rolling production is to use, instead of ingots, continuously cast blanks and slabs made of killed and low-allow steels. Replacing rolled slabs with cast slabs reduces the metal consumption by 140-270 kg/t and increases the yield by 16-17 percent. In 1986-1990, continuous casters must be built at the Imeni Dzerzhinskiy and Imeni Ilich Combines and at the Kramatorsk Metallurgical Plant. Expansion of continuous steel casting is being hindered by the limited capacities of machine building enterprises and construction-installation organizations. It must be assumed that additional reserves will be realized because of the tasks posed by the 27th CPSU Congress to accelerate scientific-technical progress.

Progressive methods of teeming killed steel in big-end-down molds using heat-insulating inserts and fillings provide significant metal savings. Enterprise experience and research results show that the combined use of inserts, exothermal mixtures and mold stools with circular flanged recesses provide the greatest savings by reducing both the top and bottom discards. The ingot metal yield is increased by 3-4 percent.

For wide implementation of these steel-teeming methods, capacity must be started up to produce thermal insulation inserts with greater resistance to burn-on and with improved thermophysical properties. Also, the technology must be implemented which uses exothermal mixtures and plates produced in the regional shop of the Donetsk Metallurgical Plant for a group of metallurgical enterprises. If 8 million tons of steel are teemed using these methods, the metal savings will be over 200,000 tons and the economic savings will be around 10 million R.

The reduction in metal consumption in rolling is determined by many factors. Large reserves for reducing the metal consumption in rolling can be utilized by improving ingot quality. A reserve is to widely implement optimum manufacture of ingots, slabs and blanks; this, together with efficient layout of rolled products, can save about 150,000 tons of metal. Furnace metal losses are reduced by: 1) increasing the temperatures at which ingots are loaded into blooming-mill soaking pits and 2) increasing the proportion of hot loading. Technology for low-oxidation heating of metal using flat-flame burners should be widely implemented. This

technology was developed by DonNIIchermet and DPI. This method is being used for soaking pits at the Krivorozhstal and Kommunarsk Combines and at the Yenakiyevo Plant. Reserves of metal economization from stabilizing the thickness and improving the precision of rolled metal are not being utilized sufficiently. These measures are designed to make fuller use of the negative field of tolerances and to supply this rolled metal according to its theoretical weight.

An important reserve for metal economization must be the delivery of rolled metal with a guaranteed overall strength. A reserve for metal economization (about 3 kg/t) is the wider implementation of the practice at the Magnitogorsk Metallurgical Combine and the Imeni Petrovskiy Plant of using blanks with rolled, defect-free ends for re-rolling on merchant-shape mills.

Methods of accelerated cooling of rolled products must be widely adopted at metallurgical enterprises. These methods significantly reduce metal losses from secondary scale formation. The experience of the Krivorozhstal and Makeyevka Combines and the Yenakiyevo Plant shows that this technology reduces metal losses by an average of 20 kg/t.

One of the reasons for the slow implementation of metal-economizing measures and for rolling-mill shutdowns is the shortage and insufficient durability of replacement parts. In order to solve this problem, one or two regional casting-mechanical shops should be built which would specialize in the manufacture of flask tooling for casting new, improved ingot molds and in the manufacture of replacement parts (circular saw blades, bars, rules, entering and delivery guides, mill-stand fasteners and straightening-machine rollers).

Plans for equipment replacement at sector enterprises during the 12th Five-Year Plan are aimed at realizing reserves of material-resource economization. Strengthening and further developing intraplant cost accounting is of principal importance in the efficient use of material resources.

DonNIIchermet has developed methodological recommendations to implement cost accounting in brigades and at sector enterprises. These recommendations regulate all aspects of the activity of cost-accounting brigades, including activities concerning material-resource economization. In particular, they stipulate that cost-accounting brigades, while meeting other indicators, must take on obligations to economize one or several types of material resources which the brigade directly uses. For example collectives in agglomerate shops can economize ore agglomerate, iron-ore concentrate or manganese ore; those in blast-furnace shops can economize coke, metal additives, fuel oil and natural gas; those in steel-making shops can economize cast iron, steel scrap, ferroalloys and ingot molds, and those in rolling shops can economize blanks, ingots, shafts etc. In addition, the workers of all shops must have incentives to economize electricity and fuel.

The sector gained 1805 new cost-accounting brigades in 1985. The number of workers in these brigades was 20.4 percent of the total number of people engaged in brigade labor. These brigades economized over 20 million R of

material resources, while the total amount of bonuses awarded was around 3 million R. In order to stimulate work in this direction, 20 shops of UkSSR Minchermet enterprises are conducting an economic experiment to develop brigade cost accounting based on reinforcing the material incentives and responsibilities of brigade collectives in major shops to reduce product costs. In 1985, 17 out of 20 shops reduced their product costs to below the plan indicator.

The first results show that this direction and the experimental conditions fulfill the proposed tasks. The shortcomings discovered make it possible to determine specific measures to improve the effectiveness of the system of converting brigades to cost accounting. An integrated solution of the problems of implementing resource-economizing equipment and technology, together with an improvement in the management mechanism, will promote the economization and efficient use of material resources.

12595
CSO: 1842/19

UDC 669.15-194.55

MECHANICAL PROPERTIES OF WELDABLE MARTENSITIC LOW-CARBON STEELS

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 27 Feb 85) pp 78-82

[Article by V. N. Nikitin, S. A. Golovanenko, V. G. Lazko, L. I. Nikolskaya and V. I. Kalmykov, Moscow]

[Abstract] A study of five martensitic low-carbon steels (0.02-0.12% C) was made, one Mn steel (03Mn4N_2V), three Mn-Ni steels (03Mn4Ni2MoN_2V, 03Mn4Ni2MoN_2VCu, 12Mn4Ni2MoN_2V), and one Cr-Ni steel (08Cr4Ni2Mo), for a determination of their hardenability and yield strength characterizing their weldability. Mechanical tests were performed after quenching from 650°C and subsequent tempering at temperatures covering the 400-630°C range. These tests confirmed that the carbon content should not exceed 0.12%. Microstructural examination with phase analysis revealed a correlation between the beneficial effect of V as alloying element and precipitation of V(CN) as disperse phase at 600-630°C, also a beneficial effect of austenite precipitating in Mn and Mn-Ni steels during high-temperature (600-630°C) tempering and then reinforcing their martensitic structure. Yield strength and heat resistance of this Cr-Ni steel with 4% Cr are lower, owing to precipitation of brittle Cr_7C_3 during low-temperature (400-500°C) tempering, and addition of 4% Mn is likely to increase the sensitivity to temper brittleness. References 3: all Russian.

2415/5915
CSO: 1842/256

WASTE IN THE METAL INDUSTRY

Moscow SOVETSKAYA ROSSIYA in Russian 24 Oct 86 p 3

[Article by V. Rybin, head of the Chelyabinsk Oblast People's Control Committee Temporary Department of Heavy Industry under the rubric "Request to the Ministry": They've Disgraced Metal"]

[Text] Chelyabinsk oblast metallurgists produce more than 17 million tons of finished rolled stock, but most machine-building enterprises scrap one of every three tons. What's the reason? First, the machine-builders themselves still use many obsolete technologies and equipment, which prevents efficient metal use. Much of it is scrapped. Second and most important, the quality of the metal itself does not always meet modern requirements. Many metallurgical enterprises do not fulfill the users' orders. And, as we know, replacing nickel steel with ordinary carbon steel results in considerable overconsumption of metal and increases the weight of goods made from it.

Therefore, the oblast's People's Control Committee recently performed a comprehensive inspection of product quality and its consumer qualities at oblast metallurgy enterprises and scientific research organizations.

Here, for example, is what was observed at the Magnitogorsk Metallurgical Works. In 5 years the amount of reject steel and rolled stock there almost doubled. Output of second-grade rolled stock is increasing. Assignments for producing economical types of metal, rolled stock from low-alloy steel grades, and hot-rolled plate are not being fulfilled.

The works' management, its engineering services, headed by Chief Engineer A. Starikov, technical department head V. Sarychev, and central laboratory head N. Bakhcheyev have almost ignored quality problems in recent years. They have not given labor collectives specific assignments to increase production of high-quality economical metal products. No system has been developed stimulate growth in output of these products.

An alarming situation has arisen in the rolling mill. Although equipment in many shops is basically worn out, preventive maintenance schedules are not observed, causing emergency shutdowns, equipment breakdown, unplanned downtime for repair, and loss of production. Both the technical department and the central laboratory, which are supposed to influence product quality

and control scientific-technical progress, are passive in this situation. And, although the combine is doing a great deal of scientific-technical work, it has not produced the required yield.

At the same time, we also inspected the Chelyabinsk Scientific-Research Institute for Metallurgy. We decided to see what is the role of this lead institute in work to radically improve the quality and consumer properties of metal. The picture there is even more alarming -- the proper initiative and persistence are missing. Narrow vision, low efficiency of developments. Most scientific research is aimed at improving existing technological processes and modernizing equipment. And the percentage of developments which represent essentially new, progressive technologies, steel grades and rolled shapes continuously declines. In the past year, for example, these developments accounted for only a little more than 19 percent.

Of course, the oblast People's Control Committee ostracized certain heads of the Magnitogorsk Metallurgical Combine, as well as Scientific-Research Institute for Metallurgy Director N. Pozdneyev and his deputy for scientific work O. Labunovich. But insufficient attention to quality problems and metal product efficiency on the part of the USSR Ministry for Ferrous Metallurgy and other central departments was also noted. Thus, a shape (plate) bending mill has long been operating at the Magnitogorsk Metallurgical Works. It can sharply increase the efficiency which with railcar builders use metal, since it produces elements virtually ready for installation. However, year after year only 62-65 percent of the machine's design capacities are used. Is this the prudent way to treat a progressive technology? Neither the Ministry for Ferrous Metallurgy nor USSR Gossnab is taking measures to completely utilize the machine, limiting orders to small lots.

Moreover, full utilization is possible if finished elements for railcars -- hatch covers, top and bottom plating, etc -- are delivered. According to statistics, the Popasyan, Velikoluks, Kanash, Barnaul, and other repair yards require about 80,000 tons of roll-formed shapes per year. Supplying them with this product instead of plate would save the national economy about 20,000 tons of metal. Savings from reducing labor expenditures would be 8 million rubles.

As the inspection showed, metallurgical enterprises themselves often take conservative positions, not wishing to take extra trouble to produce steel grades and roll-formed shapes which are more labor-intensive, but more efficient in the national economy, and they do not want to introduce promising scientific research developments. Therefore, in its resolution the committee requested the USSR Ministry of Ferrous Metallurgy to identify basic enterprises for introduction of these developments and to inform us of the decision. More than half a year has passed without response... As we see, departmental approaches, the desire to live the old way without straining oneself, still interfere with the return to glory of Urals metal.

12809
CSO: 1842/20

INTERVIEW WITH USSR MINISTER OF FERROUS METALLURGY

Moscow ARGUMENTY I FAKTY in Russian No 38, 16-22 Sep 86 pp 2-3

[Interview conducted by S. Shulgin with the USSR Minister of Ferrous Metallurgy S. V. Kolpakov: "Ferrous Metallurgy: A Time of Change" under the rubric: "Acceleration -- What Has Been Done"]

[Text] During the 12th Five-Year Plan as a result of large-scale re-equipping of the branch there will be significant improvement in the structure and quality of metal production. How are these problems to be solved? Our correspondent discussed this theme with the USSR Minister of Ferrous Metallurgy S. V. Kolpakov.

- During the first seven months of 1986, ferrous metallurgy enterprises accomplished 103 percent of their plan for sales. During this period 93.9 million tons of steel, 65.2 million tons of rolled steel, 11.4 million tons of steel pipe, and 145 million tons of iron ore were produced.

- During the 12th Five-Year Plan, 14 obsolete blast furnaces will be withdrawn from service, 70 rolling mills will be rebuilt and 38 withdrawn from service.

- Continuous casting of steel will grow by a factor of 2.3.

- During this Five-Year Plan, more than 30 new coke batteries will replace obsolete ones at branch enterprises.

- In comparison with the previous 15 years, acceleration of replacement of basic funds will be doubled during this Five-Year Plan.

[Interviewer] Serafim Vasiliyevich, as is known, our country leads the world in production of pig iron and steel. And simultaneously there is talk that we don't have enough metal. What's the matter?

[Kolpakov] During the latest Five-Year Plan, the Soviet Union has produced more ferrous metals than any other country in the world. Its share of total

world production is about 20 percent of rolled steel, 28 percent of steel pipe, and about 23 percent of steel. However we cannot escape speaking about our shortcomings, such as low quality, limited assortment , and wastefulness in using metal.

Domestic metallurgy presently is inferior to the industry of the developed capitalist countries in the production of a number of effective areas of metallurgy. Thus output of slab steel and steel plate with various coatings in the USSR is only one fifth of that in the USA or in Japan, although the use of these types of products significantly increases the durability of the products and, consequently, decreases the demand for metal.

A substantial over-expenditure of metal in machine building is brought about by the large amounts of ferrous metal alloys, especially steel. We produce more alloys than the USA, Japan, the Federal Republic of Germany, Great Britain, and France combined. But our share of heat treated metal is low, as is our share of complex profile and other progressive types of metal products. And our failure to produce these effective types leads to a significant over-expenditure of metal in our economy.

There is another side to the question which we must also mention. We do not use our metal rationally in the consuming branches of industry. We can take machine building, which uses 55 percent of the entire demand for finished product. The volume of metal used in a substantial part of domestic machinery is higher than the best foreign counterparts. Thus, a number of types of domestic agricultural machinery is heavier than its foreign counterpart by 30-40 percent, and equipment which is produced by the enterprises of the Ministry of Machine Building for Light and Food Industry and Household Appliances is 25-30 percent heavier, and our trucks are 16 percent heavier.

Finally, one of the serious causes for the shortage of ferrous metals in our country is insufficient rational structure for the design materials which are used (those intended for making machinery parts). For example, the share of ferrous metals in the overall structure of the use of design materials in the USSR is 95 percent, while in the USA it is 80 percent. This leads to an increase in the load placed on our domestic ferrous metallurgy. Our use of aluminum and plastics is held back by limits on the volumes of their production and by a determined level of complicated price relationships on the substitution of materials.

[Interviewer] What are the prospects for decreasing the volume of metal?

[Kolpakov] The basic directions for economic and social development of the USSR have called for decreasing the volume of metal in the gross national product by 13-15 percent during the 12th Five-Year Plan.

Presently the USSR Ministry of Ferrous Metallurgy is working with other ministries to develop a complex program for decreasing the volume of metal in the gross national product. It is called "Metalloyemkost [Metal Content]". It will solve problems in rational production and use of ferrous metals.

During the 12th FYP savings of metal in the economy due to progress in the development of the production of effective types of metal products is to reach not more than six million tons, which will satisfy almost 40 percent of the growth in demand for metal products.

The pivotal problem in renewing metallurgical production is the technical re-equipping and reconstruction of steel making and rolling production, and the removal from use of a number of obsolete equipments.

The sharp acceleration in the tempo and scale of renewal of basic funds will b3e achieved due to fundamental restructuring in investment policies. During the FYP, more than 50 percent of the capital outlays in the branch are intended for use in reconstruction and technical re-equipping of operating enterprises.

[Interviewer] In the basic directions for economic and social development of the USSR it states, "Improve the structure of metal production." What does this mean?

[Kolpakov] This means that the share of rolled steel plate will increase. Correspondingly there will be an increase in the production of cold-rolled steel with various types of anti-corrosion coverings, of complex profile rolled steel and welded pipe.

There is an increase in production and the quality is being raised on pipe for the petroleum industry, and it is intended to start producing no fewer than 500 new shapes of rolled steel, and to more than triple the output of metal powders. Work will be broadened in the industrial adoption of equipment for direct use of iron. More attention will be paid to the production of new economical types of production - aluminum slab and plate, thick wall complex profile, the most exacting defectoscopy of rolled steel, amorphous alloys, high-durability automobile sheet steel, cable, fasteners. Customers will be considered, and there will be massive-scale organization of the output of improved quality rolled steel.

[Interviewer] The branch's enterprises are polluters of the environment. What steps are being taken to protect the environment around metallurgical plants?

[Kolpakov] Actually, we have heretofore not paid much attention to this problem. We thought that our main task was to produce metal, and the rest of it was secondary. Now that we have outstripped the developed countries in volume of metal production, we are able to increase our attention to environmental protection.

In its environmental protection activities the ministry is taking the following basic directions. We are introducing the leading technological processes and low-waste technology. We are equipping the sources of harmful discharges into the atmosphere with gas-scrubbing equipment. We have created recirculating systems for water supply without discharge of spent water into reservoirs. We are renewing damaged ground, and we are creating industrial safety zones around our enterprises.

I want to note one very important distinguishing feature of the growth of metallurgy in the 12th FYP. That is the growth in the output of rolled steel and other metal products will be achieved without increasing the production of pig iron, coke, and iron ore. And their production, as we know, is the most harmful from an ecological point of view.

An important part of the work in preventing environmental pollution is the use of industrial waste and secondary fuel and energy resources. Almost two thirds of the slag which is formed during the production of pig iron and steel is used to satisfy the needs of construction and agriculture. From this slag we obtain cement, crushed stone, mineral fertilizer, and recovered metal which is returned to the enterprises. Such combines as the Zhdanov Combine imeni Ilich, Azovstal , and the Novolipetskiy Combine not only are reprocessing slag, but they have started developing the dumps. A third of the branch's demand for fuel, and this is tens of millions of tons, is satisfied by the use of secondary resources.

Work continues in organization industrial safety zones at the Magnitogorsk, Kuznetsk, West Siberian, Zhdanov imeni Ilich, and Azovstal Metallurgical Combines and at many other enterprises of the branch.

The exhausted open pit mines which were previously written off are being refilled with overburden which was removed and with a layer of black earth. Every year we renew some 2,000 hectares of damaged earth.

[Interviewer] Right now one of the important directions in the activities of work collectives is the activation of the human factor. What can you say about the new approach to this problem at the branch's enterprises?

[Kolpakov] Earlier worker initiatives have been directed for the most part toward completing established planned tasks. Today this plan is being developed directly and determines the technical and social policies of the enterprise.

There is an increase in the responsibility of the populace at all levels for handling business. With this end, for example, we are appointing deputy directors for commercial-financial and economic work at the enterprises.

There is a growing number of question whose solution has to be worked out with the agreement of the collectives.

[Interviewer] Caring for people. For ferrous metallurgy this has a special meaning, since much of its production is connected with labor which can be harmful to the worker. What is being done in this area?

[Kolpakov] All enterprises have developed and confirmed five-year plans for social development, a basic part of which are complex plans for improving working conditions and worker safety, industrial safety measures for the 1986-1990 period, and a whole complex program which is called "Zdorovye [Health]".

During the FYP along with the technical re-equipping and reconstruction of shops there will be created at the enterprises technical means for protection of labor. The overall cost for this to the ministry will be five billion rubles.

We are sharply increasing our attention to protection of health and decreasing illness among the workers. This makes use of the experience of the Novopipetskiy Metallurgical Combine and the Yuzhnyy Mining and Ore Benefication Complex [GOK] in preventive medicine and decreasing illness. The branch program "Zdorovye" was developed for the 12th FYP. The program is intended to decrease illness by no less than 15 percent.

9016
CSO: 1842/1

RESTRUCTURING IN FERROUS METALS INDUSTRY DISCUSSED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 16 Sep 86 pp 1-2

[Article by S. Smirnov: "The Profile of the Restructuring" under the rubric: "The Minister Answers You". An interview with USSR Minister of Ferrous Metallurgy S. Kolpakov]

[Text] "I support the new rubric of the newspaper SOTSIALISTICHESKAYA INDUSTRIYA," writes S. Abramenko from Donetsk Oblast. "Such a dialogue is truly necessary," writes R. Fedorov from Chelyabinsk Oblast. "Popular participation in the discussion of the main problems in developing the country, and that's why it is a good idea to have it in our paper," writes V. Astakhov in Moscow. These are only some excerpts from more than 100 letters that the editors received from readers after we started the column "The Minister Answers You" in the July 30th issue of SOTSIALISTICHESKAYA INDUSTRIYA. The first who agreed to answer the readers' questions in this column is the USSR Minister of Ferrous Metallurgy, Serafim Vasiliyevich Kolpakov. Ferrous metallurgy is one of those branches of industry whose work rhythm is felt by the nation's entire economy. Therefore, we have invited into this conversation all those who are upset, worried, or interested in the problems and the workings of ferrous metallurgy and the outlook for its growth.

And so, answering the readers of SOTSIALISTICHESKAYA INDUSTRIYA is the USSR Minister of Ferrous Metallurgy, S. Kolpakov.

[Interviewer] "Serafim Vasiliyevich, when is the last time you visited a metallurgical plant? Did you meet with the workers? What did you get from this meeting?" This question was asked by reader V. Kravchenko from Dnepropetrovsk Oblast.

[Kolpakov] I visit three or four enterprises each month. I always meet with the workers. The most recent meetings were at the Azerbaydzhanskiy Pipe-Rolling [Truboprokatnyy], the Rustavskiy Metallurgical and the Zestafonskiy Ferroalloy [Ferrosplavnyy] plants, the Chiatura Manganese [Chiaturamarganets] Association, and the Moscow Serp i Molot Plant. I also visited the Magnitogorsk Metallurgical Combine, the Azov Steel ["Azovstal"] Combine, and the Metallurgical Combine imeni Ilich in Zhdanov. I consider such meetings to be extremely important for myself. One good thing is evaluating the work of the plant in terms

of the accounts and reports sent to the ministry and another is drawing conclusions after personal contact with the people at the site.

[Interviewer] A group of readers from Komsomolsk-na-Amure asks that you compare foreign ferrous metallurgy with ours.

[Kolpakov] For a number of years, the Soviet Union has led the world in volume of production of steel, pig iron, rolled steel, pipe, coke, and iron ore. The Novolipetskiy Metallurgical Combine, for example, is the first enterprise in the world where all the steel is made using the continuous process method. The scientific and technical level of a number of domestic equipments is very high, including our oxygen converters with 300-350 ton capacity and our continuous casting machinery.

Soviet metallurgy, however, still lags in the production of a number of effective types of metal products. Compared to the United States or Japan, we produce only one-fifth the steel plate and sheet with various types of coatings. The number of types of rolled steel we product is less than the USA, as is our share of sheet and heat-processed metal, complex shape, and several other progressive types of metal products.

The program for technical re-equipping of the branch during the 12th Five-Year Plan [FYP] promises to overcome the lags.

[Interviewer} Serafim Vasiliyevich, there were many questions addressed to you from specialists, designers, and inventors. Vacuum steel, intensive technology in the production of pig iron, making barium-containing alloys, increasing the durability of pig-iron moldings... We realize that it is impossible to answer all these questions in the newspaper...

[Kolpakov] We in the ministry are taking a look at these matters and everything which works in the interest of the state is being considered. And if it suits you, we can answer them in the newspaper.

[Interviewer] It suits us. And in all there are several requests in the mail which are of general interest. The Deputy Chief Designer of the "AvtoKrAZ [Kremenchug Automobile Plant] Production Association, I. Verkhovskiy, asks, "When will the USSR Ministry of Ferrous Metallurgy obtain the capacity for thermal-shaped steel which will satisfy the demands of the machine building branches?"

[Kolpakov] The volume of heat-treated rolled steel is constantly increasing. This year we will reach 9.9 million tons, and in 1990 -- 15.5 million tons. In 1987 all rails for the Ministry of Railroads will be made only in the heat-tempered form.

There has been a whole program developed for heat-tempering rolled steel during the 12th FYP. Construction of a shop for heat-tempering beams to be used at the Kremenchug Plant during this FYP is now taking place at the Nizhnetagilskiy Metallurgical Combine.

[Interviewer] "An enterprise subordinate to the Ministry of the Electronics Industry together with the Moskovskiy Institute for Steel and Alloys and the TsNIIChM [Central Scientific Research Institute for Ferrous Metallurgy] have developed a very inexpensive electron-ion sensing element for rapid determination of the amount of oxygen dissolved in liquid steel. Seemingly there is no need to explain the importance of the work. According to the USSR Ministry of Ferrous Metallurgy the need for these sensors is one million units per year. The enterprise set up production in response to this order. However, in the last three years, the demand for them has only been one-fourth or one-fifth of this amount. Why has the interest in these sensors decreased?"

This question was from A. Tabanakov.

[Kolpakov] I think you are incorrect. The interest in these sensors has not decreased. Introduction of the technology for processing steel outside the furnace using sensors has already been effected at a number of the branch's enterprises and this has allowed us to substantially improve the indicators for steel-making production. The 1986 demand level for the items was 160,000.

One million sensors per year, as you write, is more than the USSR Ministry of Ferrous Metallurgy has expressed. Our demand for them will increase in step with the technical re-equipping of the branch. But the quality of the sensors satisfies us completely.

[Interviewer] "One major question is accelerating scientific-technical progress. It can be interrupted if equipment is ineffective, with long investment pay-back periods. This would lead to a lag in the technical level of production.

In connection with this I would like to ask these questions. Do you think that the intent for the next 15 years to replace martensite steel production with converter and electric-melt [furnaces] and partial updating of agglomerate, coke-chemical, and blast furnace production -- a program which will cost more than 10 billion rubles -- encompasses the newest technology which will sharply increase the effectiveness of production? How soon will these expenditures be amortized? What do you think of the proposal in principle about the new technology for melting steel from any sort of metal charges with a decrease in the use of agglomerate, coke-chemical, and blast furnace production? This technology will allow us to use the shop buildings, to decrease the cost of steel by 30-50 percent, to increase its quality and to decrease the expenditures of fuel by one-half to one-third. Shouldn't the adoption of this proposal be accelerated?" Question is from V. Lupehyko, a senior scientific fellow on the steel metallurgy faculty of the Urals Polytechnical University imeni S. M. Kirov.

[Kolpakov] Yes, I think that the intended program for technical re-equipment and development of the branch, which is based on the latest scientific-technical achievements and developments and past industrial testing, is the very basis which will allow a significant increase in the effectiveness of metallurgical production and its technical level. Concrete technical-economic

indicators which can be achieved at each metallurgical conversion are determined in complex programs.

Certainly the programs themselves are not in some way set in stone, eternal. The appearance of new, more progressive technology will certainly find its niche for use in the branch without delays and without procrastination.

Concerning the new technology for steel making about which you asked, I can say one thing. If there is a way found to equip experimental units with such equipment with minimum capital outlays, then we are ready to look at it in an energetic way.

[Interviewer] Serafim Vasiliyevich, both the readers and the editors would like to get a more concrete answer. In preparing for this meeting, we asked our own correspondent for Sverdlovsk Oblast, V. Semenov, to meet with V. Lupehyko. It became clear that as early as 1981, having completed theoretical development, he appealed to the USSR Ministry of Ferrous Metallurgy with a proposal to organize at one of the metallurgical plants an experimental validation of the new principle for a melting unit during the 11th FYP, but this was not actually done. Now the 12th FYP has begun. The scientist again is knocking on every door and until today has received only promises in reply.

This same fate has befallen the innovative work of Doctor of Technical Sciences, Professor A. M. Bugeyev of the Magnitogorsk Mining and Metallurgy Institute, as was recently written up in "Pravda."

If a way can be found... Could it be that the USSR Ministry of Ferrous Metallurgy has to first to everything to find such a way?

[Kolpakov] I have to say that one of the methods for non-blast furnace technology of steel production is already undergoing experimental testing at a metallurgical plant, and as far as the other goes -- planning work is already in progress for developing the new installation. According to the task from the ministry, in the near future there will be developed and planned proposals for equipping an experimental installation for testing the technology which V. Lupehyko proposes. It will be at one of the Urals metallurgical plants. After the test results are in, a decision will be made concerning construction.

[Interviewer] We have received the following question in the mail. "Has it been necessary to punish anybody from the ministry's apparatus or from the VPOs [All-Union Industrial Associations] for inaccuracy at work, for red tape, or for non-compliance with the orders of management?" This question is from V. Ivanenko from Dnepropetrovsk.

[Kolpakov] Starting after the April, 1985 Plenary Session of the CPSU Central Committee, the restructuring in the branch led to increased demands for work from all of the apparatus of the ministry and the VPOs for everyone from the engineer to the minister. It is natural that we began to more closely question the leadership about completing the decisions which were made and their service obligations. It was necessary to punish some people of the

ministerial apparatus and the VPOs. This year alone, six persons have been reprimanded. Receiving a reprimand was the Deputy Chief of the VPO "Soyuzogneupor" [Refractory Materials Industrial Association], A. Drivinskiy, for violating the terms for evaluating the pronouncements of citizens. Also punished was a deputy department chief in the "Soyuzmetallurgprom" VPO [Metallurgical Enterprises Industrial Association], O. Bondar, for exercising poor control over completion of schedules for deliveries of metal products. There were also reprimands issued for unsatisfactory organization of work in adopting the achievements of scientific-technical progress and saving material resources.

But these measures were coercive. Today the apparatus is working better. And we are placing special emphasis on the use of incentives.

[Interviewer] Muscovite V. Panasenko and I. Katkov from Chelyabinsk Oblast and other people ask what the ministry is doing to protect the environment.

[Kolpakov] First of all I want to note a very important distinguishing feature of the growth in metallurgy in the 12th FYP. It is that the increase in production of rolled steel and other types of metal products will be achieved without any increase in pig iron, coke, or iron ore output. And production of these, as is known, is very difficult from the ecological point of view.

Further growth in continuous process steel casting will be achieved. In this process the discharge of harmful substances into the atmosphere will be decreased six-fold in comparison with traditional casting and molding.

New coke batteries are equipped with units for smokeless charge loading and for dust-free coke output. During this FYP the branch's obsolete coke batteries will be replaced by the introduction of more than 30 new coke batteries. Our equipping of gas scrubbers on blast furnaces, martensite furnaces, open-hearth furnaces, ferroalloy and roasting furnaces and agglomeration mills continues, particularly at Zaporozhye, Dneprodzerzhinsk, Nizhniy Tagil, and Chelyabinsk. In Magnitogorsk, Novokuznetsk, and Zhdanov we are continuing work on establishing safety zones around the metallurgical combines.

In a word, much is being done, but there is still a lot to do.

[Interviewer] A personal question, Serafim Vasiliyevich, from reader V. Semichenko. "What is the first entry in your work record?"

[Kolpakov] The first entry in my work record was made at the Ashinskiy Metallurgical Plant in 1951, when I was accepted as a crew chief of foundry men.

[Interviewer] Serafim Vasiliyevich, now a letter from drilling masters Ye. Makarov, G. Sokolov, G. Kulakov, and S. Fedorov from the Noyabrskneftegaz [Noyabrsk Oil and Gas] Production Association. It is a lengthy, anxious letter concerning pipe quality.

"Several times in 'Sotsialisticheskaya Industriya' there has been severe criticism levies against the Azerbaydzhanskiy Pipe-Rolling Mill and the

Sinarskiy Pipe Mill. We would like to add that ever poorer quality casing pipe is produced by the metallurgists of the Nizhnedneprovskiy Pipe Mill imeni Karl Libnekht. Despite processing, last year due to this pipe in the Muravlenskoye drilling Directorate there were three accidents, and so far this year there was one in the same drilling directorate. The overall damage amounted to hundreds of thousands of rubles.

Judge for yourself. Some 40-45 percent of all the pipe delivered to us is rejected. And this scrap is sent to us over a distance of one thousand kilometers and is hauled throughout the country to Siberia."

Letters from geologists and oil workers from Tyumen addressed to the Chief of the USSR Ministry of Ferrous Metallurgy's Iron and Steel Pipes Industrial Association [Soyuztrubostal], A. Fotov, do not get enough attention and response, and almost always result in perfunctory replies. We ask that you take quick action which will relieve the oil workers of these endless palliatives. We would like an answer to a direct question. Are the pipe mills going to be able to produce a product that is up to world standards during this FYP?

[Kolpakov] I understand and share the upset of the letter's authors. They are correct. Our pipe workers have not been able to restructure to product pipe for deep drilling soon enough. Now plans have been developed for technical re-equipping of pipe mills and we are making up for the time that was lost. Capabilities will be introduced for thermal hardening for pipe used in the oil business. Tasks have been set up for producing this pipe at the level of quality of the best foreign counterparts during this FYP.

Significant growth is intended. Therefore, in answer to the second question that the masters posed, I can confirm that we are paying special attention to this area of our work.

The Azerbaydzhanskiy Pipe Mill was censured, but I think that the pipe delivered after the first of July of this year will satisfy the demands of the oil workers.

[Interviewer] A letter from a brigade leader of electric welders at the Lebidin GOK, Evgeniy Danilovich Chernyak, is presented in full.

"In his speech in Khabarovsk, Mikhail Sergeyevich Gorbachev, speaking about social matters, said, 'If a manager forget about the social sector, he has not finished his work, and then our plans will be doomed.'

This was very strongly stated, and my coworkers and I approve and support this course for our party with all our hearts. This has a special meaning for us. The Lebidin GOK is the largest in the country, and an enormous amount of resources have been expended on it. There are 15,000 workers employed here, and there are almost no community service facilities. The combine is 20 years old this year, and we have no Pioneer camp, no dispensary, no "real" vacation center, guest house, or sanitorium (something we tried to build). We have no stadium, no swimming pool, no greenhouse. We have no subsidiary farm. We have been promised these things at every conference for a number of years. At

the same time a number of enterprises of our ministry, such as the OEhMK [Oskolskiy Electro-Metallurgical Combine], the Stoylenskiy GOK, the KMAruda [Kursk Magnetic Anomaly Ore] Combine all have subsidiary farms and rest facilities in the south and here. And the ore-equipment plant had set up a subsidiary farm within six months of the new director's arrival.

Many of us would like to do some work using our own resources, such as building housing and community-use facilities.

In many shops there are no normal shower facilities, and in some there are none at all. And if the removal of the old production facilities keeps up, the miners will soon have no place to wash up. Nobody can say when new shower rooms will be built to replace the ones that were taken out.

The matter of community use facilities is poorly addressed in our city of Gubkino. There is no childrens' hospital, and one can't get into the polyclinic and hospital for adults. There is no stadium. There is no gym.

A year ago and the party conferences for accounting, there were mining directorates and combines galore, including myself, and we sharply stated the questions about housing and community-use facilities. Present there was Deputy Minister L. Antonenko, but our questions still have not been answered.

Isn't it about time to question those who are guilty of this situation and to answer my friends and me about how these matters will be resolved during the 12th FYP?"

[Kolpakov] The letter is justified; the author is completely correct. We must recognize that the ministry is guilty of the fact that in Gubkino, at the Lebidin Combine, such a situation has arisen. We are now taking steps to accelerate construction of housing, schools, child care facilities, and other community-use facilities.

In the 12th FYP plan for capital construction, we plan to build 120,000 square meters of living space for the combine's workers. This is 23,000 more than was built in the preceding FYP. Also planned are a 310-place dispensary to be completed in 1987, 1,120 child care facility spaces, a 120-bed children's hospital, and a 560-place Pioneer camp.

We think that the combine's management and its party, Komsomol, and trade union organizations are mobilizing all of the collectives to complete the social program, but there is a great deal that can be done with its own forces, as has been done by the metallurgists in Lipetsk, the workers of the Yuzhnyy GOK, and a number of other combines.

The 12th FYP includes plans to accelerate the growth of the social infrastructure for the entire branch. For 1986-1987 there are plans to complete community-use production -- community-use rooms, dining facilities, medical facilities -- up to the level of the very best enterprises. The responsibility for this is entrusted to Deputy Minister L. Fadukevich, and also to the chief engineers of the enterprises. The volume of housing construction in the branch during the FYP must increase by a factor of 1.4 in

comparison with the previous FYP, while the number of workers will decline somewhat during the same period. Before the end of the FYP, the problem of child care facilities will be completely resolved. Together with centralized capital outlays for housing construction, we intend to use also part of the resources which are intended for industrial-use projects, and the resources of the allocations for community-service enterprises.

[Interviewer] "We are concerned about the fate of the Sulinskiy Metallurgical Plant, which is more than 100 years old. It is said that the martensite furnaces and rolling mills will soon be closed, since this equipment already has one foot in the grave, and in place of them a powder shop will be build. Others say that the shops will be rebuilt and expanded. What has the ministry decided?" This question was in a group letter from the inhabitants of Krasnyy Sulin.

[Kolpakov] A great deal of attention has been paid to this veteran plant in recent years. It is the world's largest producer of iron powder, which is very important for our country. New buildings are to be built and equipped with the latest technology. Along with this, there will be reconstruction of the old metallurgical production facilities, whose employees have inherited a tradition of excellent performance.

The city and plant managers know about these changes and certainly were obligated to tell all the workers and inhabitants of Krasnyy Sulim about them. Well, there is some talk about "openness." This was certainly underscored at the 27th Party Congress. And as important as openness is at the center, it is even more important in those places where the people live and work.

[Interviewer] "The metallurgist profession is losing prestige because the branch's plants perform a great deal of hand work. How will this be decreased?" S. Azarov, Kommunarsk.

[Kolpakov] It cannot be denied that the question is a difficult one. During the 12th FYP the absolute number of workers who perform hand work will be decreased by 17 percent. This is planned in the targeted complex program which was developed by the ministry. However, the tempos of technical re-equipping of the branch allow us to hope that we can decrease the proportion of hand work even further.

[Interviewer] But by the end of the FYP practically one-fifth of the ferrous metallurgy work force will be occupied with heave, non-productive labor. Can there be that much of a switch, Serafim Vasiliyevich? And there are enterprises such as the Belgorod Avtoremgormash Plant where more than half of the collective do hand work.

[Kolpakov] This is because many managers of our enterprises, unfortunately, are slow in paying proper attention to people matters. This is the cause of the large difference in working conditions. Take, for example, the Novolipetskiy, West Siberian, and Cherepovets Metallurgical Combines, the Serov Forging, Rechitskiy Metal Articles, and the Magnitogorsk Calibration Plants, and the Volzhskiy Pipe Plant. Here the specific number of workers who perform hand work is significantly lower than the branch average.

And here is another approach. The management of the Kuznetsk, Orsk-Khalilovskiy and Chelyabinsk Metallurgical Combines; the Moscow Serp i Molot Metallurgical Plant; the Kuznetsk Forging Plant; the Vnukovskiy Refractory Articles Plant; the Chiaturamarganets [Chiatura Manganese] Association; the Pervouralsk New Pipe, the Azerbaydzhanskiy Pipe-Rolling plants; and the Kushvinskiy Rolled Beam Plant are all not yet satisfactorily working on this very important social-economic matter.

We have developed and distributed samples of about 50 types of special machines and units. However, so far the machine building ministries refuse to engage in series production of these machines. And they are essential for mechanization of work in operating capacities. In some cased licenses were granted (such as for the "Orbita" machine for attaching refractory linings to steel casting ladles, a unit for flame gunite laying in converter linings, and a unit for plasma processing of ingots, stock, and other things.)

We, certainly, are taking steps to manufacture machines using our own resources at repair plants and at ferrous metallurgy enterprises. But for cardinal resolution of this problem, we need the help of the machine builders.

[Interviewer] "My questions concern a matter which we both are working on, and so I request your forgiveness in advance for my directness," is how Engineer A. G. Androsov from Belgorod Oblast begins his letter. "Construction was begun on our Yakovlevskiy Open Pit Mine in 1962, and about 100 million rubles have been expended on it, before the first level is started up -- something that at today's rate is far in the future. When will this lengthy construction be ready? And a second question. What do you think about electing supervisors?"

[Kolpakov] First concerning the Yakovlevskiy Open Pit Mine. The problem is evacuating colossal volumes of water, and the lack of reliable domestic equipment for these purposes doe not allow us to force the work. In September of this year there was scientific research work done to supplement the evaluation of the construction project for the Yakovlevskiy Open Pit Mine and the development of proposals to accelerate it. The ministry sent a group of experts to Belgorod. This group consisted of leading specialists from the branch. I ask that you inform this group of your suggestions concerning development of the Yakovlevskiy iron ore deposit under these difficult hydrogeological conditions.

Now, concerning the election of supervisors. As was noted at the 27th Party Congress, practice is showing the viability of such a thing. We think it is necessary to expand the election process to that of all brigade leaders and supervisors of small collectives. In naming the supervisors of large production facilities and combines, we will consider the opinion of the people.

[Interviewer] "Our plant produces bridge supports [for mining] from rolled steel which produced by metallurgical enterprises. But its quality leaves

much to be desired. This causes rejected material, a great deal of waste, and failures during processing. Wouldn't it be better to manufacture the supports right at the metallurgical plants, and therefore not waste resources in transporting the rolled steel?" This question is from A. Shamrin, a worker at the Bryankovskiy Mining Repair Plant in Voroshilovskaya Oblast.

[Kolpakov] You are correct in asking this question. Right now we are working with the USSR Ministry of the Coal Industry in working out the designs for metallurgical production of supports. The metallurgists are working successfully with the miners on the problem of high-quality supports. The output of low-alloy rolled steel was adopted at the Kuznetsk , Kommunarsk , and Azovstal Combines. They have already delivered about 19,000 tons of supports.

The Cherepovets Metallurgical Combine has started production of highly economical complex shaped supports.

[Interviewer] A. Maksimov in Kazan asks, "Metal is laying about everywhere. What is being done to gather it in a timely manner and to put it to work? Also the collection of scrap metal from the population is not being done the way it should be."

[Kolpakov] You are correct; there is a problem here. But I must say that there is a lot being done now to solve it. standardized documentation determining the increase of the responsibility of the All-Union Industrial Association for Secondary Ferrous Metals Procurement, Processing, and Sales [Soyuzvtorchermet] and of the organizations and enterprises which hand over scrap. The documents concern the collection and processing of industrial metal scrap. A system has been introduced for tangible rewards for separating out non-ferrous metals, high-alloy steel, and tool steel from this scrap.

Presently it has been decided to create cooperative organizations for collecting scrap from the population and processing secondary materials, including ordinary metal scrap. This work is being coordinated by the Main Administration for Procurement, Utilization, and Delivery of Secondary Raw Materials [Soyuzvtorresursy] of the USSR State Committee for Material and Technical Supply [Gossnab].

[Interviewer] And nevertheless, Serafim Vasiliyevich, the measures about which you speak are evidently insufficient. We make this evaluation again based on the letters to the editor. Every day our readers cite actual addresses where you might fine whole loads of metal scrap. And one can fully understand the heartfelt complaint from reader K. Yesaulov, "When will it be that there will be no scrap metal laying about?"

[Kolpakov] I tell you directly that I myself dream of this. Well, the normal return of metal saves hundreds of millions of rubles. But how often the common good is not considered!

[Interviewer] There are specific proposals in mail addressed to us. For instance, V. Ivanishchev from Saratov Oblast thinks that it would be

correct to provide new equipment, spare parts, and . · metal . . only when all the equipment which being written off is delivered to Vtorchermet or some other processing organization. And V. Ryazantseva from Minsk thinks that it would be useful to hold competitions in the nation for the best procurers of metal scrap and to publicize these people, like the best manufacturing people are. And there is yet another suggestion. This one comes from V. Petrenko in Zhitomir. He suggests we organize an all-union voluntary working Saturday [subbotnik] for collecting scrap metal and tentatively call it "Metal Day." What do you think of these proposals?

[Kolpakov] I strongly support all these proposals.

[Interviewer] "I have two questions for the minister. Who do you rate the state of economic. work in the branch? Don't you think that the ministry's contribution to the output of goods for community use is still small?" This is from engineer V. Galitskiy in Moscow.

[Kolpakov] Improvement of economic work in the branch is something we consider a first priority matter.

During March an expanded collegium of the ministry looked at the task of fundamental restructuring of economic work. The material from the collegium were presented more fully in the sixth [i.e. June] issue of the magazine "Planning Management [Planovoye Khozyaystvo]" for this year. There is increased demand from the managers of economic, financial, supply, and commercial services to decrease costs, for growth of labor productivity and profits, for decreasing excess stocks of high value supplies. The standards for expenditure of rat material, fuel, and material were strengthened, inventories of surplus high value materials were done, and they were sent with the help of the USSR State Planning Committee [Gosplan] to other branches.

The steps we took had positive results. For the first time in many years the branch began to fulfill its plan for profits, even though now it is much harder pressed to do so that it was before.

I agree with you, Comrade Galitskiy, that we are not producing enough goods for the communal market, especially those which would satisfy the increasing demand from the populace. In the plan for the 12th FYP we anticipated increasing our output of goods for communal use and for the economy by a factor of more than 1.5. To resolve this important social problem we will use almost all enterprises in the branch.

[Interviewer] And here is another interesting, in our view, letter from Teacher L. Karsanovaya from Tulskaya Oblast. She complains, "There are virtually no small mugs or bowls with handles for sale. Kindergartens and day nurseries are suffering. Glass dishes are an awful lot of trouble. When we go to the woods we want that which does not break, and which takes up little space, and there is no way to get them." She is seconded in that by A. Krasnykh, from Sverdlovsk, "In order to buy simple white enamelware one must spend a great deal of time, and you can walk through several stores and come away empty handed. I have seen here in Sverdlovsk in July and August sets of enamelware which are roughly finished and tasteless..." In the letter from

our female reader there is a whole program for increasing the quality of dishes.

[Kolpakov] I will directly task someone to look at the proposals from L. Karsanovaya and A. Krasnykh.

[Interviewer] "What is your interpretation of the term 'acceleration?'" asks Engineer G. Rasumnevich.

[Kolpakov] I cannot state it any better than Mikhail Serveyevich Gorbachev stated at an aktiv meeting of the Khabarovsk party organization on July 31st this year. It is true that nobody has any quick answers for how we are to provide acceleration. We all have to learn as we go, solving new tasks en route. The key to this is in the hands of our branch.

In the center of attention of every manager and worker in the branch must be the struggle for quality of production and 100 percent fulfillment of orders, economic work, technical re-equipping, and successful solution to social questions.

The first positive results are already in. As a whole according to the eight-month totals for this year the branch has worked in a stable way and has exceeded the plan. But that which is done is only the beginning, and there is a great deal of work ahead of us.

9016
CSO: 1842/1

UDC 621.762:620.1:620.178

EFFECT OF HEAT TREATMENT ON STRENGTH AND TRIBOMECHANICAL PROPERTIES OF L-NiCrNb MATERIAL

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 17 Jun 85) pp 74-77

[Article by I. D. Radomysel'skiy (deceased), G. G. Lvova, A. A. Mamonova and V. D. Zozulya, Institute of Materials Sciences Problems, UkSSR Academy of Sciences]

[Abstract] A study of L-NiCrNb material produced by methods of power metallurgy was made, this material containing in its heterogeneous structure Ni in solid solution with Cr, Nb, Mo, Al alloying elements and Mo_2C superhard inclusions. The purpose was to determine the effect of adding Nb and heat treating by aging after normalization on the mechanical strength and the tribomechanical properties of this material. The material was aged at 750°C (L-NiCrNb-7) and at 850°C (L-NiCrNb-8). Microstructural examination of original Ni powder and of both L-NiCrNb grades after aging was done in an x-ray diffractometer with Co-line radiation. Specimens of both grades were tested for flexural strength, tensile strength, yield strength, and toughness under impact of temperatures covering the 20-1000°C range. Specimens were also tested for friction and wear, whereupon their surface hardness was measured with a PMT-3 tester and the surface structure was examined under an MIM-4 microinterference microscope. The results indicate that addition of Nb improves the wear resistance and heat treatment by aging hardens the material through formation of the superhard γ'-(Ni_3Al) phase, which improves the mechanical properties at temperatures up to the aging temperature but degrades them at temperatures higher than that. References 7: all Russian.

2415/5915
CSO: 1842/259

UDC 669.18.046

MECHANISM OF DISSOLUTION OF SPENT CARBON LINING FROM ALUMINUM ELECTROLYZERS IN Fe-C MELT

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 28 Feb 85) pp 16-19

[Article by L. Yu. Nazyuta, M. Ya. Medzhibozhskiy and B. L. Kuzminykh, Zhdanov]

[Abstract] A new technology for the open-hearth steelmaking process has been developed at the Zhdanov Metallurgy Institute and implemented by the Metallurgical Combine imeni Ilich, namely use of spent carbon lining from aluminum electrolyzer plants as additional heat carrier. Such a spent lining, pieces of anthracite, coal, coke, or pitch saturated with electrolytic NaF and other slag liquefying substances but containing a minimum of detrimental impurities like sulfur and volatile matter, offers economic advantages as well as technical ones. Optimum utilization of this material in the steelmaking process depends on its dissolution in the Fe-C melt. A study based on hot simulation in an IST-006 laboratory induction furnace of 60 kg capacity, with cylindrical model specimens of lining material immersed in the melt, has revealed that dissolution of this material proceeds through diffusion. With a 1:2000 weight ratio of lining material to melt, the temperature could be maintained constant throughout an experiment of 10, 20, 30, 40 s duration. The dissolution rate depends on the length of the thermal period, in which the lining material heats up to the temperature of the melt, and on the likelihood of this material disintegrating under the influence of oxides in the slag and CO. The thermal period was found to last 20-30 s in a Fe melt containing 2.0-3.5% C at temperatures below 1550°C and at most 10 s in a Fe melt containing 0.2-2.0% C at temperatures above 1550°C. In the latter case the likelihood of the lining material disintegrating is greater, especially when the Fe melt does not contain more than 0.5% C, and the dissolution rate increases appreciably. An analysis of data based on the linear velocity of the dissolution front and on an exact equation of dissolution kinetics for a solid in a liquid, includes the dissolution activation energy with erosion and crumbling taken into account as well as conditions in the boundary layer and convection of molten iron. The results of such an analysis yields the mass transfer data necessary for optimization of the melt refining, desulfurization, and steel-making process with this technology. References 6: all Russian.

2415/5915
CSO: 1842/256

UDC 669.28:539.374

MACROSTRUCTURE AND FORMABILITY OF UNALLOYED MOLYBDENUM PRODUCED BY ELECTRON-BEAM SMELTING

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 26 Feb 85) pp 109-113

[Article by V. G. Glebovskiy, M. I. Karpov, V. G. Kasyanov, L. S. Kokhanchik and N. V. Medved, Moscow]

[Abstract] A study of unalloyed molybdenum produced by electron-beam smelting was made in search of ways to increase its plasticity during forming, its plasticity being lowered by segregation of interstitial impurities at intergranular boundaries in the coarse-grained structure and resulting brittleness. Cylindrical ingots 80 mm in diameter and 1000 mm long were produced in a 250 kW electron-beam furnace and remelted up to five times. The electron beam from the vertical electron gun was aimed axially at an ingot to be remelted in the crucible above the water-cooled copper crystallizer with molten metal. While drops of molten metal collected in the crystallizer, the Mo ingots were pulled out at such a rate that a sufficient volume of molten metal remained in the crystallizer at the given superheat temperature. Specimens cut from ingots were tested mechanically in an "Instron" machine according to standard procedure. Fractographical and metallographical examinations were done under a "Neophot-2" optical microscope and a JSM-T35 scanning electron microscope. Carbon content was measured by the coulometric method in an AN-160 analyzer with a $1 \cdot 10^{-3}$% sensitivity. Oxygen content was measured by the neutron-activation method with a $1 \cdot 10^{-6}$% sensitivity. Chemical analysis and microstructural examination revealed that already the second remelting had reduced the O_2 content to below $1 \cdot 10^{-4}$%, indicating no need for an additional deoxidizer. It had also reduced C, N_2, and metallic impurities to below $1 \cdot 10^{-4}$% each, while maintaining the W content above the $2 \cdot 10^{-3}$% level. The results of mechanical tests indicate an adequate formability of the thus produced molybdenum during high-temperature pressure treatment such as hot rolling. Commercially pure molybdenum of sufficiently high quality was produced by remelting the ingots twice, first slowly at a rate not higher than 0.5 kg/min for refining and then at a higher rate of 1 kg/min for structural homogenization of the casting. The authors thank Yu. A. Osipyan and Ch. V. Kopetskiy for their interest. References 7: 6 Russian, 1 Western.

2415/5915
CSO: 1842/256

UDC 669.293:620.18:593.26

STRUCTURAL AND PHASE ANALYSIS OF OXYGEN-BEARING NIOBIUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 27 Jun 84) pp 114-118

[Article by B. Ya. Dynkina, V. P. Kobyakov, S. P. Mitrofanova, A. T. Semenchenkov and V. N. Taranovskaya, Sukhumi]

[Abstract] A study of niobium produced by two different methods was made, cast niobium produced by electric-arc smelting under vacuum with oxides added for hardening and niobium deposited from the gaseous phase after oxygenation in a HCl + O_2 stream on Mo substrates at a temperature within 1350±10 K. Specimens were polished first mechanically with abrasive powders, with fine-disperse Cr_2O_3 powder in the last pass, then electrochemically in a 15% HF + 85% H_2SO_4 electrolyte at a current density of 1 A/cm^2 for 1 min. They were subsequently etched with an HNO_3:H_2SO_4:HF = 1:2:3 mixture. Metallographical examination was done under an MMR-2R optical microscope. Microhardness was measured with a PMT-3 tester using a 0.98 N indenter. Phase analysis and measurement of the lattice period were done in a DRON-2.0 x-ray diffractometer with a $CuK_{\alpha 1}$-radiation source. The total O_2 content, in the solid solution and in the oxide phase, was measured by the neutron-activation method using the $^{16}O(n,p)\ ^{16}N$ reaction. The results reveal a matrix phase, solid solution of O_2 in Nb with a microhardness of 2.4-2.8 GPa, cast Nb containing also NbO precipitates and Nb produced from the gaseous phase containing not only NbO precipitates but also precipitates of excess oversaturated solid solution with a microhardness of 5.5-7.5 GPa. The authors thank A. M. Sirenko for analytical determination of the O_2 content. References 8: 3 Russian, 5 Western.

2415/5915
CSO: 1852/256

UDC 539.4

THE EFFECT OF DIAMOND QUALITY ON THE WEAR RESISTANCE OF COMPOSITES

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 2 Jul 85) pp 44-47

[Article by L. F. Stasyuk, G. P. Bogatyreva and I. P. Kushtalova, Superhard Materials Institute, Ukrainian Academy of Sciences, Kiev]

[Abstract] The effect of the quality of the diamond powders used in composite materials reinforced with adhesive bonds on the physical and mechanical properties of these materials was studied. AS-15 through AS132T synthetic diamonds with a 400/315 grain size and specific strength specifications were used and constituted 65% of the total composite. Near-eutectic titanium and nickel alloys with titanium carbide additives were used as the matrices. The specimens were made in a high-pressure chamber at pressures and temperatures consistent with the thermodynamic stability of the diamonds. The specimens were tested for wear resistance by subjecting them to abrasion from a PP 600X63X305 14A40NS2 grinding wheel mounted on a 3B151 machine tool and estimating the amount of abraded diamond. The tests showed that there was a positive correlation between increased wear resistance and increases in grain strength, a minimal content of metallic admixtures, and a developed grain surface. Flotation-graded diamonds also showed somewhat greater wear resistance, inasmuch as they had sufficient strength, a low concentration of admixtures, and a developed surface. After the tests, the graded diamonds were recovered from the composites and sifted to determine size retention. The size of diamonds graded through flotation and containing few admixtures were the least affected by the tests. References 5: all Russian.

13050/5915
CSO: 1842/5

UDC 679.8/055

USING A DIAMOND TOOL WITH A HELICAL BODY TO SIZE INGOTS MADE OF SEMI-CONDUCTING MATERIALS

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 31 Oct 85) pp 57-60

[Article by O. Ye. Kupershmid, A. I. Kenya and V. I. Karban, Superhard Materials Institute, Ukrainian Academy of Sciences, Kiev, and B. I. Movshchits, A. A. Litvin and I. F. Kustov, Svetlovodsk Pure Metals Plant]

[Abstract] A low-waste technologically feasible process for using special thin-walled tubular diamond drills to size ingots made of semi-conducting materials has been jointly developed by the Superhard Materials Institute and the Pure Metals Plant. The drill consists of a helical spiral body fitted on one end face with a crown bit studded with AS32 250/200 synthetic diamonds. The cylindrical part of the body carries ASM 40/28 synthetic diamonds. The drill sizes the ingots by drilling out cores of the desired size. To determine how much of the surface layer of the final product is damaged during this process, metallographic sections of silicon and gallium arsenide were examined. Ten specimens were cut at an oblique angle from a core, ground with diamond paste with a 5/3 grain size, adhered to a face plate, and polished for 20 minutes with ASM 2/1-PVM and ASM 0.5/0-PVM diamond pastes on a cambric buffer. The specimens were then pickled and examined under a Neophot-21 microscope. The size of the damaged layer was calculated by measuring the distance from the highest to the lowest points on the damaged surface and the angle between the machined surface of the plate and the surface of the metallographic section. The size of the damaged layer was significantly smaller on cores made with the helical drill than on ingots sized by conventional grinding methods, and this should result in a 10 to 12% savings in materials. References 6: 3 Russian, 3 Western.

13050/5915
CSO: 1842/5

UDC 621.762.274

EFFECT OF SODIUM IONS ON ELECTRODEPOSITION OF FINE-DISPERSE COBALT POWDERS FROM CHLORIDE SOLUTIONS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 27 Jul 85) pp 1-4

[Article by Ye. P. Zhelibo and V. N. Andrushchenko, Colloidal Chemistry and Hydrochemistry Institute, UkSSR Academy of Sciences]

[Abstract] An experimental study was made regarding the production of fine-disperse Co powder by electrodeposition from chloride solutions in a two-layer bath, its purpose being to determine the maximum permissible Na-ion concentration and accordingly the limit on raising the current density so as to optimize this technology. In the experiment a titanium disk 45 mm in diameter served as cathode for electrodeposition from an aqueous solution of $CoCl_2$ and NaCl with pH = 2.9-3.0 at a temperature of 25°C. The main concern was the unfavorable effect of Na ions in the two-layer bath, the presence of these ions tending to lower the Co-ion concentration and excessively raise the Co overvoltage so as to possibly cause desorption of organic surfactants from the passivated electrode with attendant evolution of hydrogen. Electrical measurements have revealed that increasing the Na-ion concentration shifts the polarization curves in the positive direction and increases the likelihood of saponfication at the cathode. Microstructural examination by electron diffraction has revealed that increasing the Na-ion concentration results in a more polydisperse Co powder with more densely packed and less dendritic grains. Increasing the Na-ion concentration does therefore lower the maximum permissible current density above which flotation of the disperse deposit from the cathode into the organic layer of the bath will cease, with only a friable deposit forming which partly disperses in the organic layer and partly precipitates out of the bath while the remainder on the cathode lowers the current density. In order to maximize the Co powder yield in the presence of Na-ions and to allow a higher current density for this purpose, it is thus necessary to increase the Co-ion concentration in the electrolyte. With a $NaCl:CoCl_2 \cdot 6H_2O$ = 1:10 ratio (10 g/l NaCl + 100 g/l $Cocl_2 \cdot 6H_2O$) it is permissible to raise the current density up to 40 A/dm^2 but not higher. References 6: all Russian.

2415/5915
CSO: 1842/259

UDC 621.762.27

EFFECT OF SURFACTANTS ON PROPERTIES OF COPPER POWDER PRODUCED IN AUTOCLAVE

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 10 Apr 84) pp 5-8

[Article by S. S. Naboychenko and B. N. Trushin, Ural Polytechnical Institute]

[Abstract] A study of six surfactants produced by industry or synthesized in the laboratory was made, to determine the feasibility of using them for production of Cu powder by the autoclave process. Experiments were performed in an autoclave of 1 dm^3 capacity, with 63.5 g/dm^3 Cu and a $CuSO_4$:$(NH_4)_2SO_4$ = 1 salt bath, for 40 min at a temperature of 140°C and under a partial hydrogen pressure of 2.8 MPa with each surfactant. From among approximately 80 available substances, some ionogenic and others nonionogenic, the following had been selected as most promising: 1) polyacryl amide, 2) polyacrylic acid amide + polymethacrylic acid, 3) hydrolized polyacryl nitride, 4) saponified polyacryl nitride ("Polielektrolit K-4"), 5) copolymer of methacrylic acid + sodium methacrylate ("Kometa"), 6) copolymer of methacrylic acid + methacryl amide ("Metas"). Data on the copper deposition parameters and the copper powder characteristics indicate that surfactants containing the $COOH^-$ group and polymers soluble in water are, indeed, suitable for production of Cu powder in an autoclave. Their amount is optimizable within the 0.003-0.007 g/g_{Cu} range for desired powder characteristics such as specific surface (0.02-0.18 m^2/g), bulk density (0.9-2.9 g/cm^3), mean grain size (20-42 μm), and fluidity (0-2.6 g/s). References 1: Russian.

2415/5915
CSO: 1842/259

UDC 621.762

STRUCTURE-MECHANICAL CHARACTERISTICS OF FINE-DISPERSE POWDERS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 9 Nov 85) pp 17-19

[Article by A. I. Zimin, N. F. Lobanov, A. L. Sumenkov and A. L. Suris, Moscow Chemical Technology Institute]

[Abstract] An experimental study of oxide powders (TiO_2, ZrO_2, V_2O_5, MoO_3, WO_3, Al_2O_3) and nitride powders (AlN, Si_3N_4) of 0.1-0.95 μm grain size fractions was made, for the purpose of determining the dependence of their autohesion strength and ultimate shear strength under normal load on the temperature and the pressure as well as on their mean grain size. Tests were performed in a hermetic apparatus containing argon gas under a variable pressure

up to 1.5 MPa with electric heating from room temperature up to 750 K, also a tensile loading device and a special shear loading device with a 0.5 mm thick and 22 mm wide titanium plate. The powders had been preroasted at 850 K for 1 h. The results indicate that the autohesion strength depends more strongly on the temperature than does the ultimate shear strength, both increasing with rising temperature after an initial dip to a minimum within the vicinity of 440 K. With rising pressure, the ultimate strength was found to first decrease steeply and then remain at the minimum level upon saturation of powder with adsorbed gas. Autohesion was found to become weaker with increasing grain size, indicating a transition from cohesive to loose powder. References 8: 5 Russian, 3 Western.

2415/5915
CSO: 1842/259

UDC 621.762:669.018.5

PROPERTIES OF SINTERED DISPERSION-HARDENING COPPER ALLOYS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 12 Jun 85) pp 27-31

[Article by D. S. Arensburger and S. M. Letunovich, Tallinn Polytechnical Institute]

[Abstract] An experimental study of sintered dispersion-hardening Cu+ (0.2-1.0% Cr) and Cu+ (0.5-6% Ti) alloys was made, for a determination of their properties and optimization of the aging treatment. Specimens were produced from standard Cu powder and Cr or Ti powder by mechanical mixing, compaction, sintering in a vacuum furnace, postcompaction, quenching from temperatures corresponding to existence of respective α-phase solid solutions alone, free upsetting or cold extrusion with equal degrees of plastic deformation in each case, and final aging. Hardness was measured after upsetting, tensile strength and percentage elongation as well as electrical resistance were measured after extrusion. Specimens of all alloys were examined for phase transformations in a DRON-2 x-ray diffractometer with unfiltered Co-line radiation. The hardness of Cu-Cr alloys was found to depend only on the treatment, while the hardness of Cr-Ti alloys was found to depend less on the treatment and increase with higher Ti content. The optimum aging temperature of all alloys was found to be 400°C, but the hardness of Cu-Cr alloys to be much more sensitive to change of aging temperature than that of Cu-Ti alloys. Precipitation hardening by aging was further enhanced by addition of Ti (0.2%) or B (0.1%) to Cu-Cr alloys, which increased the hardness after quenching-and-upsetting and shifted the optimum aging temperature to 450°C. Specimens of all ternary alloys were examined under a "Tesla" BS-300 scanning electron microscope with X 6000 magnification, which revealed a microstructure identical to that of the "Mallory-100" alloy (Cu+ 2.5%Co+ 0.5% Be) but with finer grains. Both tensile strength and electrical resistivity of Cu-Cr and Cu-Cr-B(0.1%) alloys were found to depend nonmonotonically on the Cr content after quenching, dipping to a minimum

with 0.5-0.75% Cr, but to become almost constant or to increase linearly over the entire 0.2-1.0% Cr range after aging at the optimum temperature. Both tensile strength and electrical resistivity of Cu-Ti alloys were found to depend principally on the Ti content and hardly at all on the aging temperature, while addition of Ti to Cu-Cr alloys increased both by a factor of up to 1.5 after aging and made them almost constant or increase linearly over the entire 0.2-1.0% Cr range after quenching as well as after aging. The percentage elongation of Cu-Cr-B and Cu-Cr-Ti alloys was found to be almost independent of the Cr content. References 4: 3 Russian, 1 Western (in Russian translation).

2415/5915
CSO: 1842/259

UDC 621.762

HEAT-RESISTANT ALUMINUM ALLOYS WITH IRON MADE OF POWDER MATERIALS PRODUCED BY RAPID SOLIDIFICATION OF MELT

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 28 Nov 85) pp 39-43

[Article by K. K. Palekha, Kiev Polytechnical Institute]

[Abstract] The feasibility of producing strong and heat-resistant aluminum alloys with a high Fe content by a powder metallurgical process, from powder produced by the recently developed method of rapid solidification of melts ("melt extraction"), is analyzed and demonstrated on the hypereutectic Al+ 6% Fe alloy. Disperse material in powder form or in any other form is produced by means of a disk made of a material with high thermal conductivity. This disk rotates fast about its axis parallel to the melt surface so that its edge touches the melt surface and intense heat transfer takes place across a small contact area. As the disk speed is increased, both solid and liquid phases will cool at higher rates with a resulting modification of the alloy powder structure. A disk 0.2 m in diameter can make the structure of the Al+ 6% Fe alloy without Al_3Fe precipitation dendritic when rotating at a speed of 100 rad/s and again homogeneous when rotating at a speed of 300 rad/s. The distribution of iron in alloy grains, according to metallographic examination and measurements in a "Kameka" MS.46 microanalyzer, indicates a far extension of the solubility limit and a fine dispersion of the intermetallic compound. With cooling rates of the order of 10^6 °C/s, therefore, it appears to be feasible to produce powders for extrusion of adequately strong and heat resistant aluminum alloys with up to 10% Fe. References 8: 4 Russian, 4 Western (1 in Russian translation).

2415/5915
CSO: 1842/259

UDC 621.762

PROPERTIES OF Al-Pb MATERIALS PRODUCED BY METHODS OF POWDER METALLURGY

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jul 86
(manuscript received 27 Sep 85) pp 71-74

[Article by V. S. Voropayev and G. Ya. Kalutskiy, Institute of Materials Science Problems, UkSSR Academy of Sciences]

[Abstract] A comparative study of two Al-Pb antifriction materials was made, one produced by rolling pellets of an Al-Pb pseudoalloy and one produced by extrusion of Al,Pb powder mixtures. Pellets were produced from a melt of 84% Al + 15% Pb + 0.5% Cu + 0.5% Sn in water and rolled with rollers 170 mm in diameter, after preheating in an electric resistance furnace. Powder mixtures were extruded in a P-125 hydraulic press into preheated molds. Tribomechanical properties were measured by standard methods in an M-22 PV machine with organic lubricant; the face of an Al-Pb strip rubbing against a roller made of ground St45 carbon steel (Rockwell C 42-45 hardness) at a constant velocity of 1 m/s under a constant load of 7 MPa. The specimens had been run in till the friction coefficient stabilized under 5 MPa at 1 m/s. For reference, specimens of the A020-1 alloy (79% Al + 20% Sn + 1% Cu) were tested under the same conditions. The results indicate that the rolled Al + 15% Pb pseudoalloy has a low friction coefficient but a high wear rate, while the extruded Al + 15% Pb mixture has a still lower friction coefficient and a low wear rate. Microstructural examination under an MIM-7 microscope revealed a much more uniform volume distribution of Pb and absence of interphase boundaries in the extruded material, which contribute to its excellent properties. References 2: both Russian.

2415/5915
CSO: 1842/259

UDC 669.018.45:621.762

SINTERING CUBIC BORON NITRIDE WITH ALUMINUM

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 17 Jul 85) pp 14-17

[Article by A. A. Shulzhenko, S. A. Bozhko, N. P. Bezhenar, A. V. Bekyankina and V. M. Tovstogan, Superhard Materials Institute, Ukrainian Academy of Sciences, Kiev]

[Abstract] Thermodynamic calculations and experimental data were used to find the region of pressures and temperatures within which cubic boron nitride interacts with aluminum to form the refractory ceramic AlN-AlB_{12}. Using a line representing zero Gibbs energy, a diagram representing the interaction between the cubic boron nitride and aluminum was divided into two regions, in one of which the ceramic was formed, and in the other of which the recrystallization of cubic boron nitride through an inversive reaction in an aluminum

melt could occur. The experimental data upheld these calculations. Specimens of cubic boron nitride sintered with aluminum were subjected to x-ray analysis on a DRON-2 in filtered copper radiation. The specimens were sintered in a high-pressure toroidal apparatus at 7.7 GPa at temperatures of 1400, 2100, 2400, and 2600 K. These specimens were subjected to phase x-ray analysis. The hardness of the polycrystals was measured with a Knup indenter with a load on the indenter of 9.8 H. A correlation between the hardness and fine structure of the polycrystals was established, as was a hardness/temperature function. References 6: 2 Russian, 4 Western.

13050/5915
CSO: 1842/5

UDC 121.762.546:273.171+669.017:536.412.5:539.89

THE SINTERABILITY AND CONTACT INTERACTION BETWEEN BORON NITRIDE AND REFRACTORY METALS, ALLOYS, AND COMPOUNDS

Kiev SVERKHTVERDYYE MATERIALY in Russian No 5, Sep-Oct 86
(manuscript received 17 Oct 83) pp 17-20

[Article by A. M. Mazurenko, E. B. Rakitskiy, T. I. Leonovich, and O. I. Pashkovskiy, Solid State and Semiconductor Physics Institute, Belorussian Academy of Sciences, Minsk]

[Abstract] The sinterability and contact interaction of boron nitride with refractory metals (iron, nickel, chromium, tantalum), certain alloys of these metals (Kh30, Kh20N80), and compounds (TiC, W2B5, ZrN) during synthesis of cubic boron nitride without a catalyst (pressure 7 to 8 GPa, temperature 2300 to 2500 K) were studied. The experiments were conducted on a D0137A compacter with a high-pressure chamber. Pressure and temperature were regulated on the basis of a pre-plotted graduated curve. The specimens were made in the form of two-layered cylindrical blanks which were heated at 7 to 8 GPa at 2300 K for 30 to 35 seconds. The contact zone between the layers was metallographically examined on an MIM-8 microscope while magnified 600 X and subjected to x-ray microanalysis on a Microskan. When tantalum was used as the backing, a transition zone formed at the point where the tantalum made contact with the boron nitride. This zone was 8 to 10 mcm wide and consisted of a mixture of chemical compounds based on tantalum and boron nitride. Iron, nickel, and chrome uniformly penetrated the layer of cubic boron nitride, and this resulted in inferior physical and mechanical properties for the specimens. When the compounds were used as backings, both materials penetrated deeply into one another in alternating sections, and this ensures high mechanical strength during high-pressure sintering of the compounds. References 5: all Russian.

13050/5915
CSO: 1842/5

UDC 669.3:621.771

MODELING TEMPERATURE DEPENDENCE OF YIELD STRENGTH OF COPPER AND BRASS IN COLD ROLLING

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 25 Mar 85) pp 66-70

[Article by Ya. D. Vasilev and V. G. Shuvyakov, Dnepropetrovsk]

[Abstract] The temperature dependence of the yield strength of M1 copper and L90, L68 and L63 brasses is analyzed on the basis of a physical model and experimental data, for the design of a cold-rolling process as hardening treatment. Specimens for measurements were cut from 5-7 mm thick commercial hot-rolled strip, some of which were further hot rolled and others were cold rolled. All were then tested in a "Rihle" (GDR) tensile-testing machine according to the USSR Government Standard 7855-74, at a deformation rate of $5 \cdot 10^{-4}$ s^{-1} at temperatures ranging from 20°C to 350°C but each maintained constant within ±3% during each test, after soaking at each temperature for approximately 15 min. The maximum error of all stress and strain measurements did not exceed 4%. The data have been fitted on curves of rolling pressure and apparent yield stress as functions of strain and of the temperature ratio T/T_m (T, °C - test temperature, T_m, °C - melting point). These curves have then been approximated with polynomials, for calculation of pressures and temperatures thoughout a rolling process. The results indicate a lowering of the apparent yield strength of all four materials with rising temperature, most appreciably as the temperature of a material worked to a high strain within the $\varepsilon = 0.6$-0.8 range rises from 100°C to 150°C. References 10: 9 Russian, 1 Western (in Russian translation).

2415/5915
CSO: 1842/256

UDC 669.15'71'782:621.785.78

DISPERSION HARDENING OF ALSIFER

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 29 Nov 84) pp 134-138

[Article by V. K. Grigorovich, Ye. N. Sheftel, I. R. Polyukhova and A. S. Mkrtumov, Moscow]

[Abstract] A study of dispersion-hardening alloys for magnetic video recording was made, namely alloys consisting of a Fe+ 9.5% Si+ 5.5% Al base with 0.5-7 wt.% TiC as hardener. Microstructural examination of these alloys revealed two-phase structures throughout the entire range, differing only in the size and shape of the carbide inclusions and the different phases existing in the various alloys. The constitution diagram constructed on the basis of differential thermal analysys reveals that this system is a quasi-binary one with a eutectic point at 3.2% TiC, this eutectic alloy melting and then solidifying at 1245°C. The microhardness of all alloys was found to increase when the cooling rate during crystallization had been increased. The microhardness was also found to depend nonmonotonically on the TiC content, the eutectic alloy being the hardest one when produced by slow cooling and an alloy with higher TiC content becoming the hardest one when produced by faster cooling. Electrically measured amplitude-frequency characteristics of toroidal specimens indicate that alloying alsifer with TiC increases the dynamic magnetic susceptibility throughout the 1.3-10 MHz frequency range. References 13: 6 Russian, 7 Western (2 in Russian translation).

2415/5915
CSO: 1842/256

UDC 669.25.859:620.18

STRUCTURIZATION OF $BaFe_{12}O_{19}$ POWDER MAGNETICS IN CROSSED ALTERNATING AND CONSTANT MAGNETIC FIELDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: METALLY in Russian No 4, Jul-Aug 86 (manuscript received 12 Jun 84) pp 183-186

[Article by G. I. Yaglo and A. S. Kotenev, Rostov-na-Donu]

[Abstract] Structurization of $BaFe_{12}O_{19}$ powder magnets before pressing by means of mutually perpendicular alternating and constant magnetic fields is evaluated, for the purpose of optimizing this technology. The object is to first separate the relatively large single-domain grains typically of the 1 μm size fraction, their high magnetic moment having caused them to form lumps, orient them and only then press them together. Taken into consideration is the intrinsic anisotropy of this magnetically hard material and that the two magnetic fields cannot change the structure of individual grains but only cause them to move relative to one another. Experiments performed with

16BI190 powder indicate that the process can be controlled by regulating the intensity of each magnetic field, with amplitude of the alternating one allowed to approach but not to exceed the coercive force of the material. Powder magnets with a maximum energy product of $10 \cdot 10^3 J/m^3$ have been produced by this method with a constant magnetic field of 900 kA/m intensity and an alternating magnetic field of 130 kA/m intensity, after premagnetization. References 4: all Russian.

2415/5915
CSO: 1842/256

THE KOLA PROJECT

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 28 Aug 86 p 2

[Article by Correspondent L. Tsvetkov: "The Kola Project: 1. Minerals and Tailings"]

[Text] "Improve the protection of minerals and complex use of mineral resources. Decrease losses of useful minerals during mining, enrichment, and processing. Provide protection to the environment of USSR economic zones and the USSR's continental shelf." These tasks from the Basic Directions for Economic and Social Development of the Nation During the 12th Five Year Plan are being incorporated into the working program of the collectives, enterprises, and associations located on the Kola Peninsula.

1. MINERALS AND TAILINGS

Nature itself has designated that the primary economic specialty of the Kola Peninsula is to be the mining industry -- the extraction, enrichment, and processing of ores. An absolute majority of the deposits here contain more than one type of desired mineral. Experience in their exploitation has been achieved on a grand scale; its science has been difficult; communication with the mainland has been needed. In a word, perhaps you will not find a better place for testing technical and organizational methods for complete utilization of mineral ores.

And why do we need such a place? Let's look at concrete situations. As a start we will take the simplest of the Kola deposits, Olenogorsk . It is managed by the USSR Ministry of Ferrous Metallurgy [MinCherMet], which so far has extracted only iron from it, and the dirt, if one can call it "dirt", has been sent directly to the tailings dump.

Nevertheless a piece of the Olenogorsk rock does not crumble under a tractor's tread. The crushed rock obtained here is both of high quality and is a very scarce construction material on the peninsula. It would seem that it is a bit easier to set up a few crushers, considering that the Olenogorsk

Mining and Enrichment Combine [GOK] would not have to learn to use them since they are the combine's basic equipment, and thus rake in additional profits.

It has not been so. There has not been the first capital expense here for ancillary work. And the miners did not set up the first crusher. The railroad workers set one up and started to sell crushed rock to the miners. Even now they buy crushed rock which has been processed by the equipment at [the railroad] quarries.

One could write them off as lost. They are paying for their own clumsiness, but it serves them right. However, if one looks at it from the government's point of view, then it is clearly mismanagement. Crushed rock is expensive at the sub-branch plant. And that's not all of it. No matter how long or short a time it has taken, they have apparently finally figured out at MinCherMet and have allocated money for this new capability. And yet they have gotten into a mess, as they say. For as Combine Director V. Basin, a new man who is not guilty of anything, has said, covering his eyes, it has begun like this.

The crushed rock shop, although it is not the wisest project, has to be built nevertheless with the project documents in hand. And in order to do the project documents, one must have the technical/economic base document. And for this one must confirm that there are sufficient supplies of raw materials -- the very country rock. Everyone knows that they are rolling in it, but for this purpose nobody can take their word for it. They demand a base figure. This means that he has to conduct exploratory drilling, if you please. In short, having the means and the agreement of the construction people, the contractor still cannot build anything because for all these decades they have not managed to calculate just what riches they are sitting on. And this project would be dropped from the five year plan if it were not for effective help from a new management organ. But more of this later.

Now let's consider a more difficult deposit, the Kovdor . It is managed, incidentally, by this same MinCherMet. It has been placed under complex development earlier, and to some extent it has been successful. The Kovdor Combine produces not only iron, but also apatite concentrate, and also baddeleyite, a raw material for refractories and some other users. In a word, the combine is "multi-profile."

We have to take a few sentences to do justice to the person who lived through reprimands and heart attacks and was standing up for -- and stood up for! -- the complex approach to the ore body. I think that nobody would object if I mention first of all Aleksey Ivanovich Sukhachev, the director of the combine. He is a typical representative of the managers of the times of the first development of the Trans-Arctic Kola. He is a newcomer among this number (after all, where were they to recruit their own cadre?), and now he hears the end of a life that is inextricably linked with the Arctic Circle, although now he looks back to it (for the North is the North, and is no place for a pensioner). But through all of this he has been a fanatic supporter of this rocky, wind-scoured, cursed yet tenderly loved peninsula. He is a representative of powerful people, and his power spreads from the shops to the city (whose enterprises are first of all city-building), and has a strong and angular character like the northern cliffs (and so of the unimportant

diplomats in the ministerial offices), of those blessed with the capacity to leave a real track on the wild land and of all the kinds of bitterly hated transients who would skim the cream of the environment. With this spirit of rejection of any dishonorable intentions is imbued the entire engineering force of these northern enterprises, as well as party and Soviet workers. This is because they first grew to manhood basically under the example of just such leaders. And this, incidentally, has created a unity of all local organs, a powerful support of the oblast party committee when they decided whether there would be or would not be complex technology in Kovdor.

But enough lyrics. We will turn again to dry economic prose. Each ton of ore from which only iron is extracted yielded a product worth four and one-half rubles. By adding production of apatite and baddeleyite it yields more than seven rubles. Is this good? It would seem so. But to the true manager this is not nearly enough. The recovery of apatite is only about 40 percent, and of baddeleyite only eight percent. And there is no extraction of rare metals, and from the present waste from enrichment there is enough phosphoric-magnesium processed fertilizer to serve the entire northwest Non-Black Earth Economic Zone.

But all of this did not immediately become clear. There were decades in which the Kovdor problem grew. But, just as in Olenogorsk, it began to be solved only recently.

A third situation that I want to talk about shook me up. The pride of the Kola Peninsula - of the country! - is the experienced much-decorated "Apatit" Association. It is prepared to decrease the volume of its production. Estimates done for the period to the year 2000 and confirmed by all the necessary bases concerning the state of the ore reserves are indisputable. The expenditures per ruble of production by the end of this millennium will almost quadruple. The number of workers will increase by one-third. The cost of the production funds are estimated to triple. And the output of apatite concentrate threatens to just manage to increase until 1990, to hold steady until 1995, and then after that to decrease.

One can understand this estimate. One cannot accept it. How can we give up the primary heavy industry in the Kola North, the two cities which have grown up around it, the center of academic science in this area, the manager of incalculable (and as yet uncounted) underground wealth, and turn it into an economic invalid, fed with charity from the budget? In the name of what? In the name of the politics of single product output? This was done at first by the Ministry of the Chemical Industry, and then by the Ministry of the Fertilizer Industry. With such politics even the nepheline which is needed for the aluminum industry -- and which account for up to 39 percent of these "khibinskiy" ores -- are for the most part relegated to the "tailings" of beneficiation and are blown away by the winds. And along with them are blown compounds of fluorine, titanium, potassium, sodium, and rare earth metals. In the name of desiring to sell the most highly saturated apatite concentrate in the world? Such a desire forces one to avoid poorer ores, and to forget that some people outside the country buy the concentrate not only for the phosphate, but also for the other components which are given to them for free. Is this not actually wastefulness?

My companion in these visits is P. Yakimov, recently a secretary of the party committee, and now the general director of "Apatit". We were possessed by the same emotions, but we controlled ourselves. It was easier for him to do. He already knows that the calculations for the alternative of the single product are thickly lined out -- forever I hope. New ones were done. And the ideas for the growth of "Apatit" as a complex association are not only on paper. Industrial test units are already operating in buildings next door to the second factory. Their chief, A. Maslov, today can show the production sites where they are ready to broaden the output of nepheline concentrate. And the supervisor of the central laboratory A. Makarov cautiously holds in his hands the first alloy, the tangible and therefore inspirational evidence that the metal product of "Apatit" is a reality.

Something else is surprising. These problems were known long ago, and the solutions in principle were not found yesterday, but are only now being implemented. This is because breaches appeared in the partitions in the administrations. This is because deputy ministers of ferrous metallurgy for mineral fertilizer production started to hold meetings and sign protocols of clear inter-authority content. And what took place? This will be discussed in the next letter.

9016
CSO: 1842/1

HIGH ALTITUDE ANULITE MINE DESCRIBED

Baku BAKINSKIY RABOCHIY in Russian 6 Sep 86 P 1

[Article: "An Open Pit Mine Above the Clouds"]

> [Text] Construction on a new open pit type anulite mine has begun not far from Dashkesan. It is at an altitude of 2,100 meters above sea level, and is one of the highest mines in the mountains in our country. Geologists calculate that its ore will last for many decades.

Anulite lies on the surface here. This facilitates extracting it and decreases costs. Also, its level of impurities is much lower, and this makes processing easier.

A road to the new open pit mine is now being built. The roadbed is paved with concrete in order to protect it from damage from the weight of high-capacity BelAZ dump trucks. Stretching for more than three kilometers, it connects the deposit with the crushing mill at the Zaglikskiy Anulite Mine headquarters. It is now being used to carry new earth-moving equipment and various types of machinery.

The new open pit mine is supposed to start operations this autumn. By that time new capacities for complex processing of anulite will be ready at the Kirovabad Aluminum Plant imeni 50-Letiye USSR, to which all of the valuable natural material which is the output of this mining directorate will be delivered.

9016
CSO: 1842/1

RESISTANCE TO TECHNOLOGY IMPROVEMENTS IN KARAGANDA DESCRIBED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 13 Sep 86 p 2

[Article by Academician D. Abishev, the Secretary of the Central Kazakhstan Department of the KaSSR Academy of Sciences and the Director of the Chemical-Metallurgical Institute of the KaSSR Academy of Sciences: "Iron is the Thing. But What About the Rest?"]

> [Text] "You can have either the plan or science," is what the specialists of the Karagandinskiy Metallurgical Combine resolutely told the scientists. This narrow organization-centered view which they took has become an impenetrable roadblock on the road toward introducing waste- free technology for complex use of iron ores from the Lisakovsk Deposit. The unwillingness to accept the responsibility leads to enormous losses of extremely valuable raw material.

It is well known to metallurgists, and the knowledge is not limited to them, that when a concentrate is richer in iron, it melts more easily in blast furnaces, and it yields more pig iron and less slag and it saves coke. Thus, for more than ten years at the Lisakovsk Mining and Benefication Combine [GOK] in Kustanay Oblast they have been producing a magnetic roast concentrate which in all parameters is superior to the prevailing "usual" gravitation-magnetic concentrate. The concentration of metal in it is some 10-12 percent higher, and there is simply no water or harmful impurities in it. They make such raw material from ore which is too poor in iron content for the old method of benefication, and is substandard. But there are millions of ton of this accumulated in the waste product dumps.

"The thing is, if it were higher in concentration, we would give it the green light," promise the managers of the Karagandinskiy Metallurgical Combine. And they willingly use it. It seems that all is good and the metallurgists are working for progress with both hands. But this is only the appearance, and the fact is much more complex, since they have gone from a narrow organization-centered position toward using the new raw material. All the advantages of the innovations are essentially cut off.

The Lisakovsk Deposit is complex, and rich not only in iron but also in aluminum, vanadium, and phosphorus. It is quite possible to separate the components and impurities and this is necessary simply due to the magnetic roast concentrate. Moreover there exists waste-free technology for complex use of the poor Lisakovsk ore. This was developed long ago in the Chemical-Metallurgical Institute of the KaSSR Academy of Sciences. It allows one to increase the productivity of a blast furnace by ten percent and to avoid throwing the resulting slag into the waste dump, but to make the very valuable metals for non-ferrous metallurgy, to make phosphorus fertilizer, high quality cement, roofing tiles, and other construction materials. If you process 36 million tons of ore by our "recipe", which is what the plan for Lisakovsk calls for, you can provide an economic effect of at least 100 million rubles. Such a conclusion was reached based on calculations which were done by the Economics Institute of the KaSSR State Planning Committee after experimental industrial scale testing of the new technology.

Incidentally, together with our scientists, that institute created a revolutionary program for complex use of the Lisakovsk ores, and coordinated it with the Union Republic Ministry of Ferrous Metallurgy and the Ministry of the Construction Materials Industry. One of the essential points is the industrial testing during which the blast furnace melt would be run exclusively using the magnetic roast concentrate. This was the target of a special order of the Soyuzmetallurgprom Association. But it, unfortunately, was not complied with. At Kazakhstanskaya Magnitka they do not want to make any cardinal change in the established technology, and they use the concentrate as an additive, "padding" somewhat improving the work of the furnaces. And the rest? "We are not a scientific test bed. To experiment in a blast furnace is extremely dangerous. One can destabilize its entire production. We are not going to do it. In a word, you can have either the plan or science." stated the chief of the combines technical department, V. Mirko, and the chief of the central plant laboratory of the enterprise, G. Tsimbal.

I am convinced that this matter is entirely safe, and the experimental test runs on a low capacity blast furnace in Alapayevsk have allowed us to assure the metallurgists of complete success. The evidence is that they do not want to restructure -- to install the new technology, to process it, and to conduct lengthy testing.

But it is necessary to restructure, since in Lisakovsk there are already operating industrial test units with annual productivity of up to 200 thousand tons of the super-concentrate. In this Five Year Plan they will activate yet another which is ten times as capable. By the year 2000 almost half of the Lisakovsk raw material will be going to the Karagandinskiy Combine. Ant not only there, to the new magnetic roast "packing." Thus they could lose everything that can be obtained along with the iron only with great difficulty. And this is at least reckless.

Incidentally, right now the Karagandians would be able to help the Pavlodar Aluminum Plant, which is suffering from a serious lack of bauxite. They have been forced there to undergo fundamental reconstruction, which allows them to process poor-quality raw material. It would be very

expensive to do this. And why would the means which could be processed at the renewed Pavlodar Aluminum Plant not be sent for the introduction of the technology which was proposed by the scientists in Karaganda? Why would the ministries of ferrous and non-ferrous metallurgy in this case not unite their forces and resources and use the ore for both?

Here one must remember that a few years ago these same metallurgists, not wanting to take risks, refused to accept the melts of gravitation-magnetic concentrate. But time has demanded that they accept the less metal-rich Lisakovsk ores. They had no other choice. The new technology was adopted under protest. Some risk! They made a mass of mistakes, and in the beginning there was a sharp decline an almost all technical and economic indicators for the combine, which could be blamed completely on the listless, systematic introduction. But then matters improved. The economic benefit of adopting the innovations amounted to 30 million rubles. By introducing throughput technology for processing the Lisakovsk concentrate, these very people -- Mirko and Tsimbal -- were among the large group of scientists and specialists who in 1984 were awarded the USSR State Prize.

But now it is necessary to move further. But the laureates, it appears, are resting on their laurels, and are placing roadblocks in the way of the new technology, thinking, as always, to "circumcise" the science. Our task in this Five-Year Plan and beyond is clearly determined. We have to make more complete use of ore raw materials. Under these conditions it is smart to include the ministries which are responsible for extracting this or that material from the ore, . to unite our forces for creating and adopting waste-free technology. In a wore, from the multitude of disagreements, suggestions, and creation of unnecessary programs we are to get to work. It doesn't make send to the waste dumps of one ministry those things that another ministry can obtain only with great difficulty.

9016
CSO: 1842/1

NEW ELECTROLYTIC METHOD FOR REFINING COPPER SOLUTION

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 10 Oct 86 p 2

[Article by V. Novikova, dateline Karaganda, under the rubric "Science for Production": "Toward Waste-Free Technology"]

[Text] Process water in electrolytic copper production is a complex raw material from which valuable products are now being extracted: vitriol, sulfuric acid, etc. But the fact is that the purification technology now being used is obsolete and does not satisfy modern requirements for either economic or ecological characteristics. Because of the low level of electrolyte purification at the Balkhash, Dzhezkazgan, Almalyk and other mining and smelting combines, the content of spent solution impurities is two to three times above the norm.

The head of the Department of Analytical Chemistry at Karaganda State University, A. Zharkenov, is only 30 years old, but already has 12 author's certificates for inventions in the field of ion exchange process chemistry.

Zharmenov's talent was apparent even in his school days. Abdurasul enrolled in the Chemical Department of Karaganda State University when he was only 15. He studied brilliantly and won a Lenin stipend. Work in the science students' society developed in Zharmenov an interest in research and determined his future: Abdurasul was attracted to a little-studied field of analytical chemistry -- ion exchange and membrane methods of distributing multicomponent solutions. Upon graduation he became a staff member of the just-created Ion Exchange Process Laboratory at the Karaganda Chemical-Metallurgical Institute.

Two years of creative searching, and Zharmenov had decided the topic of his scientific work: an essentially new method for refining a copper solution by electrodialysis, i.e.,electrolysis using membranes. Any theoretically sound idea needs repeated confirmation by experiment. How many Abdurasul Aldashevich had! His candidate's dissertation was the first work in Kazakhstan in this scientific field.

The process of recovering solutions in membrane systems not only eliminates numerous stages, but also sharply reduces harmful effluents. For central Kazakhstan, where large nonferrous and ferrous enterprises operate, a reduction in chemical pollution is both resource-saving and one of the main

prerequisites for environmental protection.

Although ionite membranes for technological processes were first used in the 60s, their use so far has been limited. The membranes' ability to retard certain elements of the many components in a mixture helps basically to remove harmful impurities from drinking water. Ion exchange methods have not been long in use in metallurgical process practice. Traditional extraction methods are not suitable for obtaining pure copper from electrolytic process water. Zharmenov followed an untrodden path. As early as 1978 he received his first author's certificate for a method of purifying copper electrolye in electrochemical membrane systems without additional reagent consumption.

Pilot production tests of the new metal were conducted at the Balkhash Mining and Smelting Combine. Not everything went smoothly right away, and problems of the most varied nature arose. The scientist persistently overcame them. For example, during installation, workers obtained nothing because of the sharp difference between existing standard setups and the test setup. Abdurasul Aldashevich himself spent 3 weeks at the Alma-Ata Electromechanical Plant to master the profession of installer. Then, at the combine, he spent 2 months helping install the setup, modernizing it in accordance with the new technology. The tests were successful.

The expanded technical council of the Balkhash Mining and Smelting Combine decided to make introduction of the new technology a priority task, since it prevents pollution of Lake Balkhash, yields additional precious metals from wastes, and increases the purity of the resulting copper.

Installation of equipment for the membrane method of recovering spent solutions is being completed at the Balkhash Mining and Smelting Combine. In forthcoming months, first-phase electrodialysis units will be started up. Savings from complete introduction will be at least a half million rubles per year. In addition, the amount of harmful effluents entering the environment will decrease 250-300 cubic meters per day. There is another side to the problem -- copper quality.

"Widely used procedures for recovering spent electrolyte are distinguished by low productivity and do not provide economical extraction of precious components as quality-standard products," says A. Zharmenov. "Comprehensive analysis of the work of the country's copper electrolyte enterprises conducted in 1984-86 by 'Unipromed' Institute specialists showed that one of the main reasons for the deterioration in the physico-mechanical properties of eletrolytic copper residue is the low level of electrolyte purification. As a result, domestic cathodic copper is now inferior in quality to that of certain countries."

The solution to the problem lies in active development of new, promising methods. Zharmenov is now working on creation of a unified technological complex for extracting precious substances from any metallurgical production wastes. This subject has been incorporated into the research plan of the USSR Academy of Sciences. Headed by Abdurasul Aldashevich, the collective of Karaganda University's Department of Analytical Chemistry is developing a

waste-free membrane technology for purifying spent solutions from the electrorefining of copper with comprehensive extraction of precious components. This flexible technology ensures efficient refining of solutions with a wide range of concentrations of various substances.

"Basic Directions in the Economic and Social Development" adopted by the 27th CPSU Congress speaks of the need to consistently attain rational and economical consumption of all types of resources, to reduce their losses, and to accelerate the switch to resource-saving and waste-free technologies. The research being conducted by the department's collective, headed by the young scientist A. Zharmenov, fully meets this requirement.

12809
CSO: 1842/20

TECHNOLOGICAL ADVANCES AT ZHOLYMBET COMBINE

Moscow IZVESTIYA in Russian 18 Oct 86 p 2

[Article by V. Guk, dateline Tselinograd Oblast: "Beyond the Horizon -- The Horizon"]

The state commission has approved the next horizon at the Zholymbet Mine of the Kazzovoto Combine for operation. For the first time a vein deposit is being worked this deep -- at the 600-m level.

Ore containing valuable metal will soon be extracted at an even greater depth -- 700-800 m. Labor input in mining is increasing. Therefore the plant has had to introduce self-powered loading and drilling equipment. This equipment is already serving miners at the Aksu Mine, where the labor productivity of cutters, for example, has easily risen 60 percent.

Other combine subdivisions are turning to progressive equipment and technology. A pilot production section was recently formed at the Bestyube Mine. There production workers, following scientists's latest recommendations, are using new ore extraction techniques.

12809
CSO: 1842/20

OXIDIZED QUARTZITE FACILITY UNDER CONSTRUCTION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Oct 86 p 1

[Article from TASS, datelined Krivoy Rog, under the rubric "Rates. Quality. Prudence": "Construction Picks Up Speed"]

[Text] Erection of the foundation of the concentration building--one of the basic projects of the Kriviy Rog Oxidized Ores Mining and Concentration Combine--has begun. Specialists and worker organizations of a number of CEMA countries are participating in its construction.

The huge foundation pit is clearly visible from the slope for its entire 700-m length. At its bottom are powerful cranes, bulldozers, and other construction equipment. Builders from Czechoslovakia are doing the work here.

"We have developed a relationship of close cooperation and mutual assistance with our Soviet colleagues," says Zdenek Mitrovski, head of the Czechoslovak management of the construction project. "Before starting to build the concentration facility, we reviewed the technology by which the construction work is performed and compiled a joint schedule of stages for turning over the project. A unique production chain resulted. As a result, we began construction of this project a half year before the contract stipulated."

A decision to supply reinforced concrete structures from the Ilichev Plant also helped accelerate project construction time. At first, the plan was to produce 17,500 cubic meters of piles in the CSSR. Naturally, this would have an effect on the rate of construction and on its costs.

Construction of the combine, called for under a multilateral agreement signed during the 37th Session of the Council on Mutual Economic Assistance, makes it possible to begin commercial processing of oxidized quartzites. Before, they were scrapped, and hundreds of millions of tons accumulated around the pits of the Southern and Novokrivorozhsk Mining and Concentration Combine alone.

Processing oxidized quartzites will also make it possible to improve environmental conditions in the Krivorozhsk Basin and put hundreds of hectares of rich earth occupied by dumps back into the agricultural cycle.

The enterprise will produce its first output in the middle of the 12th Five-Year Plan. When it reaches design capacity, more than 14 million tons of concentrate and about 13 million tons of pellets will be produced annually. Some of the raw material will go to several countries--CMEA members participating in the combine's construction.

12809/5915
CSO: 1842/20

UDC 553.6

WAYS TO MEET DEMAND FOR NONMETAL MINERALS

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 11, Nov 86 pp. 62-70

[Article by V. P. Petrov, doctor of geological-mineralogical sciences, under the rubric "Organization and Efficiency of Scientific Research": "Nonmetal Minerals and Their Importance in the Modern World"; text in slantlines printed italic]

[Text] Exploitation of nonmetal mineral resources in our country began only after the October Revolution. Tsarist Russia imported all types of nonmetal raw materials, even structural stone. In the 30s, rapid development of construction and industry made it necessary to acquire an ever increasing amount of nonmetal raw materials and to reduce their cost, sometimes even by reducing quality. These days, the acceleration of scientific-technical progress requires considerable restructuring of the nonmetal minerals industry.

THE CONCEPT "NONMETAL MINERALS"

This term is defined as any mineral resources used in the national economy from which metal is not directly produced and which are not combustible mineral resources -- caustobioliths.

All mineral resources, including metallic, are characterized by specific properties, despite the fact that the differences between one group and another are not very clear. Specifically, it is difficult to define the boundary between ore and nonmetal minerals. For example, dolomite is one of the most important structural materials. It is a refractory and one of the basic types of raw material for producing binders. It is also used in agricultural technology to lime soils. Thus, dolomite is a typical nonmetal mineral. However, in recent years it has come to be considered also as an important magnesium ore. After a method was developed for fusing dolomite with ferrosilicon and simultaneously produce metallic magnesium and cement, extraction of magnesium from dolomite turned out to be cost-effective. A considerable amount of dolomite is already being used as a source of magnesium. Equally, chromite is used as an ore in metallurgy -- ferrochrome, chrome alloys, and steel are produced from it, and as nonmetal raw material -- as refractory.

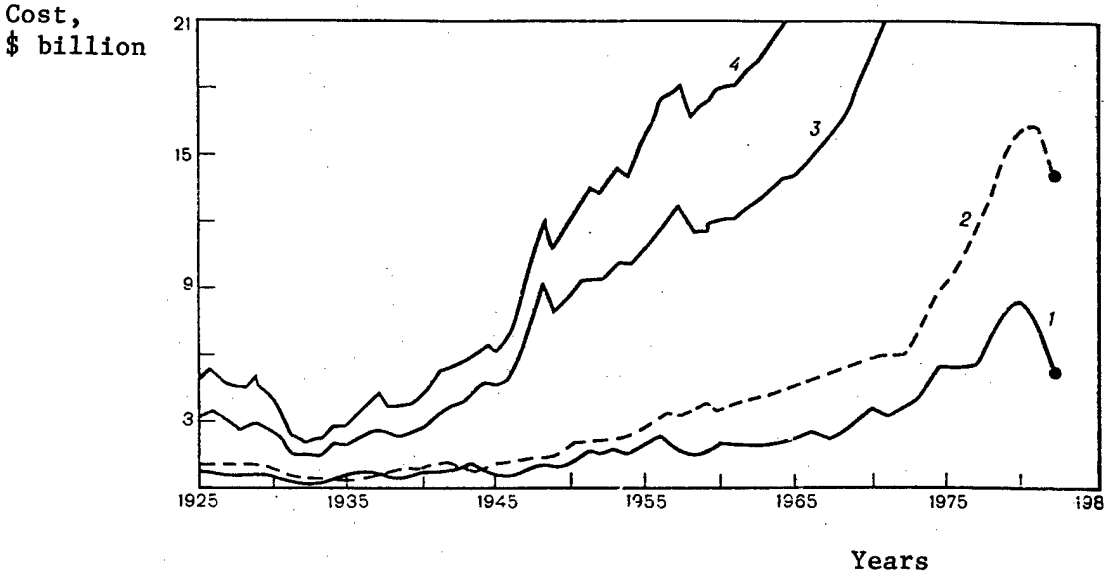
It is typical of nonmetal minerals that they are usually used after some refining. As a result, the final product almost always reflects the

properties of the raw material. The relatively low cost of most types of nonmetal raw material and the broad potential for their replacement, as well as the huge amount of nonmetal materials used results in high transportation costs, often much higher than the cost of the material and the need to organize local production and discover sources of bulk types of raw material in each individual economic region. In addition, mining operations related to extraction of nonmetal raw material have a tremendous impact on the environment. This often makes it impossible to work out many already known deposits.

In recent years, the development of industry has given rise to the demand to mine completely new mineral resources -- minerals and rocks never before considered as industrial raw material. In other cases, industry is sharply changing requirements for raw material. New refining methods sometimes make it possible to replace rare, expensive raw materials with common, less expensive ones. Many types of nonmetal raw materials previously considered very important and even "strategic" are losing their significance or have been completely replaced by synthetic products.

All these features of nonmetal minerals reflect, in our opinion, their unique nature as industrial raw material.

It is traditionally believed that nonmetal minerals are insignificant and have little effect on the economics of individual countries. In fact, this is not at all the case. For example, let us compare the cost of nonmetal raw material and metal ores mined in the USA (figure).



Change in cost of raw mineral material mined in the USA.
1 - Metal ores; 2 - Nonmetal raw material; 3 - Combustible mineral resources; 3 - All mineral raw material; after 1970, the cost of combustible mineral resources rose sharply: in 1973, $25 billion; in 1974, $45 billion; in 1975, $48 billion; in 1977, $74 billion (data from "Minerals Yearbook").

Before 1940-45 the cost of both groups of minerals was about the same.

By the 80s, the cost of nonmetal raw materials was almost double that of metal ores. It is typical that the crises of recent years have had a stronger impact on the cost of metal ores than on nonmetal raw material.

The cost of nonmetal raw material mined in the Soviet Union is about the same as in the USA. However, the total cost of nonmetal structural raw material in our country is higher than in the USA. For example, in our country output of cement is about double that in the USA (in 1983: USA -- 64 million tons; USSR -- 128,156,000 tons).

CERTAIN URGENT PROBLEMS OF NONMETAL RAW MATERIALS

In our country difficulties in developing commercial extraction and using nonmetal raw materials are closely related to the departmental subdivision of consumer interests and to the unwillingness of several specialized ministries to expend resources on side production of goods not assigned to it. There is one more reason why very valuable deposits are lost. Individual institutions make their own activities easier by unreasonably making GOSTs so strict that raw material considered to be of highest quality abroad is scrapped.

We might point out ways to significantly increase use of almost any type of nonmetal raw material. However, the switch to these methods is often delayed by fear of new capital investments or simply by fear of departing from the habitual "old ways." Of course, the framework of this article does not permit a complete summary of the already clearly outlined prospective changes pertaining to raw material sources or to its processing or consumption. Therefore, we will limit ourselves here to only certain examples which, in our opinion, are most pressing.

/The problem of aluminum oxide, sodium carbonate, and cement./ Aluminum and aluminum oxide, an abrasive and refractory, are very important materials in the national economy and are consumed in large quantities. There are obviously not enough aluminum ores (bauxites). According to economists' estimates, most of the worlds bauxite reserves will be exhausted by the year 2000. There remain only certain deposits in Australia and perhaps India, where bauxite deposits with high-quality ores have only recently begun to be discovered.

In the USSR, the scarcity of bauxite resources has been noted ever since World War II. Therefore, Soviet chemists and metallurgists have made an intensive search for ways to produce aluminum oxide from other types of raw materials. This search culminated in development of the so-called nepheline process. Aluminum oxide plants in Leningrad Oblast and a combine in Achinsk in Krasnoyarsk Kray operate with this process.

The essence of the nepheline process is as follows. Nepheline is a mineral rich in aluminum oxide and sodium ($Na_2Al_2Si_2O_8$; Al_2O_3 = 31-34 percent; Na_2O=10-15 percent). When alloyed with lime $CaCO_3$ it yields a highly water-soluble sodium aluminate and large amounts of "belite slurry." It is easy to separate aluminum oxide Al_2O_3 and sodium carbonate Na_2CO_3 from the sodium aluminate solution, and belite slurry is almost finished cement. Most important for the national economy are, of course,

the aluminum oxide and extremely scarce sodium carbonate, but cement accounts for the largest portion of the total cost of the product. Aluminum oxide plants near Leningrad, where cement is easy to make, produce the most inexpensive aluminum oxide. The combine in Krasnoyarsk Kray, which has no cement users and has to warehouse a considerable portion of the belite slurry, produces aluminum oxide and sodium carbonate. While plants gravitating to Leningrad are highly profitable, the combine in Achinsk is only at the break-even point.

Cement production is now being organized in close proximity to consumers, since transporting cement and its raw materials more than 300-500 km is unprofitable. Several cement plants in our country completely satisfy this requirement. Thus, the Novorossiysk Plant uses local marls, which are a high-quality cement stock. Bryansk plants produce cement stock, mixing chalk lime, Paleojurassic montmorillonite clays, and younger tertiary opoka. These and other similar plants which use raw stock from different deposits should perhaps reconsider their raw material base and switch to operating on the nepheline process.

As we already said, one of the most important products of the nepheline process is sodium carbonate. This is a very inexpensive product, since the raw stock to produce it (common salt and lime) are rather cheap. Sodium carbonate has long been produced at the Sterlitamak Soda Association, where there is surplus natural raw stock. Wastes from sodium carbonate production -- calcium chloride produced in amounts approximately equal to sodium carbonate -- are a problem. Industry is using some of this product, but there is simply no place to put the rest. It cannot be dumped into rivers, since it kills all living things. It cannot be buried in the ground since it dissolves in ground waters, fills wells, and again enters rivers. Finally, it cannot be stored in piles, since it absorbs water from the air and deliquesces. So, "white dead seas" stand on excellent arable land, taking up many hectares of agricultural area. The central press has already written about them, but it is as yet impossible to do anything with them. (See IZVESTIYA, 1984, 9 September; 1985, 17 January.)

Chemical production of sodium carbonate in the USA has virtually ceased. Americans were unexpectedly lucky: a series of unusual bituminous shales called the Green River Series was discovered among tertiary deposits in Wyoming. It contains several quite valuable minerals, including trona -- sodium decahydrate. Trona was at first considered a great rarity, but it was later discovered that this mineral forms beds 1-12 meters thick in the series. Then industry became interested in the sodium carbonate in the series. The first mines dug in the Green River strata in the mid-70s turned out to be quite profitable and now not only meet the country's current demand for sodium carbonate, but also permit a considerable portion of its output to be exported.

Thick seams of davsonite $NaAL(OH)_2CO_3$, also once considered rare, have been discovered in the same Green River Series in Utah and Colorado. This mineral can yield both sodium carbonate and aluminum oxide.

It has already been clear for several years that our country must search for sodium carbonate minerals. Manifestations of davsonite have been discovered

in Belorussia, but, unfortunately, at great depths. Interesting davsonite finds have been made in the Kuzbass, where the search for this mineral continues.

A new mineral, anhydrous sodium carbonate (natrite -- Na_2CO_3) was recently observed in Khibiny alkaline rock among the nepheline syenite. It was released from the same magma melt from which the nepheline syenite itself crystallized in the depths of the Earth. It is still unclear how much of this mineral is concentrated there. The sodium carbonate found in the alkaline rock has no commercial value, but its very presence is quite encouraging and forces us to continue searching.

This summary shows the exceptional urgency of creating aluminum oxide plants operating with the nepheline process. But, despite numerous attempts by the USSR Academy of Sciences to accelerate widespread introduction of this technology into industry, the "nepheline problem" in our country is still unsolved. (See "Meeting of the Active Members of the USSR Academy of Sciences Devoted to Problems of Accelerating Scientific-Technical Progress," VESTNIK AN SSSR, 1986, No. 1, pp. 15-17; Aleksandrov, A. P., "'Basic Directions for Economic and Social Development of the USSR for 1986-1990 and for the Period Until 2000' and the Tasks of the USSR Academy of Sciences," Ibid., No. 5, pp. 4-8.) In addition, the Soviet Union still has no other realistic ways to obtain the extremely scarce aluminum oxide and sodium carbonate. However, the nepheline process is profitable only if not only aluminum oxide and sodium carbonate, but the cement as well are used. The existing cement industry is directed as a whole toward satisfying the country's demand for cement separately, with no regard for the need to obtain aluminum oxide.

Geological and economic examination of ways to develop the nepheline process and of opportunities to partially shift the cement industry to this process is quite advisable. It is even more advisable for the main equipment in ordinary cement plants be close to the equipment in plants using the nepheline process.

A few words about the raw material for the nepheline process. Nepheline is obtained in large quantities as a byproduct during concentration of Khibiny apatites. Only a small portion of this nepheline is used; the rest is discarded and pollutes local lakes.

/The Problem of Sand-Gravel Materials./ Modern construction uses a huge amount of these materials, which are found along river beds and form fluvial terraces and other level areas serving as plowed fields, flooded meadows, or pastures. When gravel-sand mixtures are extracted, these areas are irreversibly destroyed.

European countries, as well as the USA and Canada, are struggling with an acute scarcity of gravel-sand mixture. As the first step in correcting this scarcity, these countries have begun to estimate the remaining resources which could be used to some extent. Estimate of these resources in Finland has shown that small amounts of sand-gravel materials are found only on the border with the USSR (the Sortavala and Vyborg rayons) and on the border with Sweden. More intense exploration, mapping, and estimation of sand and

gravel resources in France, England, and in the eastern USA and Canada are being done. Because they have no dry-land areas where sand and gravel can be extracted without destroying the environment, France and the USA have switched to extracting these minerals on the seacoast. Structural sand and gravel are being recovered on both the French and English coasts of the English Channel. "Banks" containing sand-gravel product have been discovered on the California coast, and they are beginning to be exploited.

Even a state such as Kuwait, located on a sandy desert, is experiencing difficulties due to the lack of structural sand and gravel. Kuwaiti geologists are also trying to solve the problem and have discovered coastal areas of sand and gravel deposits, since desert sand is too fine-grained and also impure.

The Soviet Union as yet has no lack of areas where sand-gravel mixture for construction can be obtained. However, several rayons, e.g. on the Black Sea Coast of the Caucasus, are feeling a lack of sand-gravel materials. Until the 60s, construction in Batuma, Kobuleti, Chakva and other places was done using cement blocks filled with beach sand and gravel. Only recently has it been discovered that the catastrophic destruction of resort beaches has been caused precisely by this use of beach material. Now, to save coastal beaches, artificial crushed stone is being poured in certain especially opportune areas of the shore, and coastal currents are carrying the stone to the required places.

Exploration for sand and gravel deposits is going on intensely in the Black Sea water area on the Crimean coast and in the vicinity of Odessa.

A second rayon where there is a problem with sand-gravel mixture is Tomsk. (See IZVESTIYA, 1985, 2 July.) Millions of tons of gravel are taken from the bed of the Tom River, and, as a result, there is danger that the river's level will drop and that it will become significantly narrower.

These examples show that even our country has developed a need to study sand-gravel mixture resources, primarily near cities and industrial centers, to prevent Tomsk's history from being repeated in other rayons.

/Argillaceous Raw Material./ Up to now, having exhausted some good deposits of high-quality clay, industry has moved to others, where the best areas can also be developed with no concern about loss of the worst. However, argillaceous resources are far from limitless, and in many rayons we already cannot anticipate discovery of new deposits which could replace depleted ones. In addition, development of the Soviet Union's eastern rayons requires finding deposits of high-quality clay. Argillaceous raw stock is now being transported from the Ukraine to the ceramic and paper factories of eastern rayons -- Priangarya, BAM rayons, Khabarovsk Kray, Primorya. Transportation costs are many times higher than the cost of obtaining raw material at the mine.

We now know of three main commercial types of clay: kaolin, montmorillonite (bentonite), and palygorskite clays, which differ greatly in terms of properties and applications.

Kaolins are rich in aluminum oxide and poor in iron. The iron in kaolins

can form only independent mineral impurities. Without these minerals, kaolin clays are completely white in raw form and remain so even after roasting. They contain a relatively large amount of aluminum oxide (to 30-40 percent Al_2O_3), which ensures high heat resistance. Kaolinite crystal dimensions and perfection may differ greatly. Therefore, the plasticity of kaolin clay varies.

All these properties are widely used in industry. The whiteness of raw kaolin is used in the paper industry, where kaolin is a paper filler. It fills the interstices between plant (cellulose) fibers constituting the paper's base. The more kaolin a paper contains and the whiter the kaolin, the better the paper. Yellowness in paper in many cases results from its lack of pure, especially white kaolins. Low-iron kaolins are the basis for porcelain production: the purer the kaolin, the whiter the porcelain. High aluminum oxide and low iron contents in clay are important in refractory production: the higher the clays' plasticity, the easier it is to manufacture them.

Before the revolution, domestic industry used no native clays at all. They were imported from Germany and England. Only after the revolution were many very large deposits discovered, e.g. the plastic refractory clays near the village of Chasov-Yar in the Donbass and Latnensk clays near Voronezh. Plants producing refractories for ferrous metallurgy were built in these locations.

It first seemed that clay reserves in these deposits were limitless, and their resources were incorrectly estimated. However, years passed and the better parts of the deposits were exhausted. To extend the life of the Chasov-Yar plant a little longer, geologists are searching for new clay deposits, but everything they find contains clay far inferior to the old deposits' clays.

In Voronezh rayon, Latnensk clays are deposited in narrow, elongated lakes (oxbows), which developed when ancient rivers overflowed and migrated. Now these deposits have been almost entirely worked out, and no new deposits have been found in adjacent rayons. It is possible that the local refractory plant will have to switch to raw stock brought from far away and, possibly, entirely cease to exist. It is true that geologists have still not given the final word. Many plastic kaolin clay deposits in the Urals have also been exhausted.

Kaolin for the paper industry is supplied mostly from pits where so-called primary kaolins are worked and concentrated. Their deposits are in the Ukraine and in certain rayons of northern Kazakhstan. Kaolin flakes in these deposits are relatively large, which is very good for filling paper, but undesirable for coating it, where a fine flakes are needed. American specialists have proposed several methods to obtain fine-flaked kaolin from alluvial secondary kaolins. In our country, secondary kaolins are found in the Ukraine, but they are used only to produce refractories. Methods have to be developed to obtain a fine flake from secondary kaolins to coat paper and to allocate certain deposits to the kaolin industry. This should be done even before enterprises producing refractories -- the largest consumers of secondary kaolins -- exhaust all the reserves in the Ukraine.

Development of methods to concentrate secondary kaolins and kaolin-containing sands is very important also for obtaining kaolin in the Soviet Union's eastern oblasts. Here are found sand deposits containing -- in addition to quartz -- kaolin and feldspar, which could be used in the paper and ceramic industries. Work in this area has already begun. A gigantic kaolin combine which, according to current plans, should produce kaolin, feldspar, and pure quartz sand -- raw material extremely scarce throughout the Far East -- has been built in the Zeysk-Bureinsk Basin. However, the combine does not yet produce high-quality output. The reason is more or less clear. Kaolin-containing sands have been prospected as the placer of heavy ferrous minerals, and therefore have been used as a complex raw material. The presence of a relatively small amount of ferrous minerals is extremely harmful in feldspar, kaolin, and quartz, since ferrous minerals contaminate all nonmetal raw stock with iron, even in decomposing placer. We must find iron-free kaolinic sands which could yield the required raw material near the combine. There are theoretical grounds for such exploration.

Montmorillonite, unlike kaolin, is often contaminated by various impurities, especiallly ferric. As result, these clays are easily sintered. They are widely used to produce "coarse ceramic," structural brick, and claydite (swollen clay in the form of small, light, highly porous, globular granules which acts as a light concrete filler). The European part of our country is quite rich in coarse ceramic clays, but there are very few such clays in Siberia, Khabarovsk Kray, and Primorya, and they must be prospected there.

Pure montmorillonite clays, so-called bentonites, are capable of yielding rather stable gels together with water (viscous structural fluids). If this clay is poured into a glass with 10-20 grams of water and the mixture stirred, the resulting gel can be kept several days, and the clay will not settle in the glass. This property is used in oil drilling: drilling solution produced from the clay is pumped into a well and used to wash out all drilled-out rock. Since our country is doing a great deal of drilling, finding clays for drilling solutions near oil recovery areas is extremely urgent. Clay is now delivered to western Siberia from the Transcaucasus, and the best grades of clay for drilling solutions are imported from abroad.

Montmorillonite clays are used also in ferrous metallurgy. In the blast furnace process, where ore is reduced by the action of gases permeating the ore bed, concentrated powdered ore cannot be used since this ore covers the gases' route. Powdery iron ore undergoes pelletizing: the charge material, flux lime, and coke, as well as a some bentonite clay, are added to it. Then all charge ingredients are carefully mixed and held together by the clay; they form into pellets 15-18 mm in diameter. Intense roasting converts the clay into "stone," giving the pellets high strength. "Pelletized" concentrated ore travels to the blast furnace, and this preparation promotes a sharp increase in blast furnace productivity.

Very high requirements are imposed on clay in pellet production: it must quickly consume water, create a strong raw pellet which should not break up during rapid, intense roasting, and after roasting should not crumble in the blast furnace. However, the clay requires additional flux, increases slag output, etc. Therefore, the less clay used in preparing pellets, the better. It is no accident that not every clay is used in ore pelletization.

The USA has deposits of excellent bentonite clays, but preferred to use Italian clay recovered on the island of Ponce near Naples to pelletize ores. This clay produced good pellets when it constituted about 0.75 percent of the charge, while it took about 1 percent of local clays. Bringing clay from Italy to the USA and paying 10 times more for it than for local clay (Ponce clay in the 70s cost $100-200 per ton, while the best American clay was calculated at $10-12 per ton) was profitable, since a 0.25 percent reduction in clay content increased metal yield. However, the USA has now had to do without clay from Ponce. Despite the high cost and the demand for it, at the end of the 70s the Italian government completely prohibited any mining on the island. The island of Ponce is part of a resort zone, and extracting bentonite seriously disturbs its environment.

Exploring for high-quality bentonite clays yielding stronger pellets with a lower clay content is one of the important tasks of Soviet geologists. Such deposits have been discovered in Georgia and Turkmeniya, but other deposits closer to ferrous metallurgy enterprises must be found.

This article has reviewed not nearly all types of nonmetal products obtained from the Earth' interior, but taking several as examples, we tried to show what must be done to better meet the demand of the national economy on its path of intensification,

First, we must switch from high-volume types of raw mineral open cuts (sand, gravel, structural clay, rubble) from economically developed oblasts or those with natural preserves to rayons of less economic importance: shelf areas, seacoasts, remote mountains, rocky areas, etc. To do this, we must now make a regional estimate of the large-scale resources, especially close to their major consumers: cities, power plants, industrial enterprises, etc.

Second, reserves of scarce bulk raw material with many applications (refractory clays, secondary kaolins, bentonite clays, plastic china clays, etc.) should be estimated fully, with recording raw materials of all types. Scarce raw material should be used in the most important branches of industry, and, where technology permits, branches should be switched to low-grade raw material. Estimation of the raw material in the Earth's depths is best done by geological services; its state of preservation and use for direct purpose are best monitored by mining supervision.

Third, new types of nonmetal raw materials and new technologies, e.g. the nepheline process -- simultaneous production of aluminum oxide, sodium carbonate, and cement -- should be introduced into commercial production in industrially developed rayons. Geologists should continue to search for raw sodium carbonate resources in the Khibiny, iron-free kaolin-quartz-feldspar sands in the eastern rayons, and deposits of secondary kaolin.

These problems can be solved only with the widest participation of planning organizations, industrial ministries, and USSR Academy of Sciences scientific institutions.

12809
CSO: 1842/28

THERMO-MECHANICAL MACHINE DESCRIBED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 6 Sep 86 p 3

[Article by S. Zemlyak: "An Almost 'Perpetual Motion' Machine"]

> [Text] A mockup of a mechanical arm sits on the laboratory table. Its "hand" has two fingers. It opens; it closes. It knows no other motion. A pair of springs are stretched between its "joints". And about a meter from the mockup there is an ordinary fan. L. Manasevich, a scientific fellow in the department of metals physics, turns it on and as soon as the rubber blades begin to turn, the mechanical arm, having closed its "fist" on a polyurethane foam cube, lifts it. There is a turn in the "shoulder" and a movement of the "elbow" and the cube again sits on the table. Manasevich turns off the fan and the arm comes to rest. He flicks the switch again, and again the arm starts working. Why does it move when a breeze blows across it?

I am provided with the answer in a round-about way. Candidate of physical-mathematical sciences V. Gyunter suggests I bend a metal wire into the form of a common office paper clip. This is not complicated, and I bend it without effort.

"Now take it by the ends in your two hands -- hold it a little tighter."

V. Gyunter holds a lighted match to the site of a bend. The wire immediately straightens out, easily overcoming the resistance from my fingers. Then having cooled, it again is bendable as wax.

"You have in your hands a part made of titanium nickelide, an alloy which has a thermo-mechanical memory for form," the scientist explains. "During manufacture of this wire, it was designed to be straight. As you see, at room temperature it is plastic, and is easily deformed. When it is heated, its memory of its form is immediately activated, and muscle force does not suffice to interfere with the straightening."

The technology for manufacture of such alloys was developed here, in the Siberian Physical-Technical Scientific Research Institute [NII] at Tomsk

University. For about ten years now the alloys with form memory have been used in medicine. And now the metal physicists have begun to solve the technical problems.

The mechanical arm was created by Aspirant A. Kuznetsov under the leadership of his laboratory chief, Candidate of physical-mathematical sciences A. Kotkov. The springs within it are made from titanium nickelide. It is quite easy to cool them with a stream of air from a fan, since the alloy falls in that temperature range in which the memory of form is developed. When the "shoulder" is turned, the manipulator leaves the stream of cool air, and it operates with a return spring.

"Suppose," it occurs to me, "that this is..."

"A perpetual motion machine?" The researchers smile. "It really is like one. But certainly it is not perpetual motion. It is only gratuitous operation, since the energy for accomplishing work is extracted from the environment.

The department of metal physics of the Siberian Physical-Technical [Institute] is one of three domestic centers which make technical systems based on alloys with form memory. Another is in Kiev at the Institute for Metal Physics of the UkSSR Academy of Sciences, and the third is the Durability Laboratory of the NII for Mathematics and Mechanics at Leningrad University. Incidentally, the metal physicists themselves are convinced that it is already time to unite the forces of the Tomskians, the Kievans, and the Leningraders and create a unified scientific-production association.

In Petergof, near Leningrad, we met V. Likhachev, a Doctor of physical-mathematical sciences, a professor, the chief of the durability laboratory. His design for an machine based on titanium nickelide is very much like the unforgettable pictures of the perpetual motion machine from Ya. Perlman's "Entertaining Physics."

There is a common wheel. Instead of spokes, it has springs -- the same ones with form memory. When you dip half the wheel into warm water, it starts to turn. It does not stop until the water cools to room temperature. The idea is the same as in Tomsk, but the technical embodiment is somewhat different. When they are slightly heated in water, the springs "remember" the fact that they have to compress. Compressing, they displace the eccentric axle a bit downward. Exiting the water, the springs straighten out. And this goes on without end.

Incidentally, the classical laws of thermodynamics do not allow for such an effect. Nevertheless, the wheel turns. Moreover, although Likhachev and his colleagues have not calculated the energy balance of the machine, it has always turned out that in practice there are rather smaller temperature drops than theory would dictate. So far this phenomenon is still inexplicable and intrigues the metal physicists no less than do the prospects for using the machine.

And these are quite varied. Even today at the institute there is an impressive example of a water-cooled machine being built. (This is a warmer medium than air.)

"The merits of the new machine are many," Likhachev says. "It has a high efficiency factor [KPD] and its working body can take several forms. It has enormous power capacity, a large energy yield at low capacity, is noiseless, and is ecologically non-polluting."

Even today a small series of such machines are being readied for production. And in a few years, the scientist thinks, it will be possible to put them into series production.

9016
CSO: 1842/1

INEFFICIENCY IN AUTO PARTS SUPPLY DESCRIBED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 11 Sep 86 p 1

[Article by G. Gundarin: "Slipshod Workers Ride the Shortage"]

> [Text] Why is it that some slipshod ferrous metallurgy organizations are allowed to have a disgraceful attitude toward the production needs of enterprises upon whose quality work the rhythm of the nation's automobile assembly lines are dependent?

At this point in time the acting chief engineer of the Krasnaya Etna Plant, V. Ivanov, was lost in thought. But then he decisively picked up the papers concerning the substandard metal and wrote on them the sweeping resolution, "Accept as an exception."

"Well, that's that." He leaned back in his seat. "Now all one has left is to wonder about the consequences."

Each year the Gorkiy Krasnaya Etna Plant processes hundreds of thousands of tons of metal. Its products are fasteners and springs for automobiles. It supplies nuts and bolts made in various shops to the combined assembly lines of the Gorkiy Automobile Plant (GAZ), the Zavolzhskiy Motor Plant, the AZLK [Moscow Automobile Plant imeni Leninskiy Komsomol], and the ZAZ [Zaporozhskiy Automobile Plant]. And if you consider that some 50 kilograms of these parts are needed in the assembly of each automobile, then you can understand how huge the volume of these deliveries are. They include the vital fasteners used in the joints of the car which are vitally important, and upon which traffic safety depends.

That is why at the plant they so carefully check out the quality of the metal that arrives. But, alas, often this goes only to completely confirm the lack of quality [of the metal]. In the shops they showed me bolts and nuts made from this metal. They are covered with cracks, with flaws in their grain. There are boxes of substandard products sitting in all the passageways, and they are sent to the scrap pile by the ton. But why, pray tell, is it necessary to wittingly send substandard metal to the production shops? Because there is simply no other metal. And they must produce fasteners. Otherwise the assembly lines of the automotive giants will come to a halt;

otherwise thousands of assembly workers will have nothing to do. That is why the management of Krasnaya Etna , brushing economy aside, has had to accept poor-quality metal for processing, on the off chance that at least part of the articles made from it will be completely suitable. In searching for good fasteners, dozens of people sort a mountain of nuts and bolts by hand. Often they do this in a rush. The shop is already waiting for an impatient signal from the machines sitting idle at GAZ or from Zavolzhe.

Thus one wave of rejection leads to another. What sort of metallurgy is this? It is possible that they don't know about this? Certainly they know. Each month at Krasnaya Etna in the presence of representatives of the manufacturing enterprises several papers concerning rejection of metal are drawn up. And the situation gets more complicated. This year the volume of defective material arriving at Krasnaya Etna has increased more than six-fold.

Especially evident is the metallurgy of the famous Magnitka, which supplied more than 1,600 tons of substandard raw material to Gorkiy. More than 400 tons of it was from Krivorozhskiy Metallurgical Plant. More than 300 tons of substandard steel was sent to Gorkiy by the metallurgists in Zlatoust.

"They really have us cornered," complains the deputy chief of the technical control department [OTK] at Krasnaya Etna , A. Gongalyuk. "The representatives of the metallurgical combines arrive and depart and the amount of rejects keeps increasing!"

But how then are we to interpret this fact? This year the Gorkians did not return a single gram of substandard metal, and did not levy a single fine against the supplier. How does one explain such liberalness in dealing with a slipshod organization?

"Well, the suppliers have us bound hand and foot," exclaims Gongalyuk. "Look at the mechanics of the situation..."

And he walks to the office of the representative of Krivorozhstal , V. Bakun.

"Did you think it over?" he asks of him, continuing a conversation that was begun the previous day. And he explained to me, "Recently there arrived here from this enterprise a large amount of substandard metal. The representative himself is able to confirm this. Yesterday we jointly came to the conclusion that the fairest solution for both sides is the following. We will send as much as we can of the substandard metal to production here, and from there send it to the automobile plant, and we will write off the reject to the metallurgists. But in any case, Vasiliy Petrovich decided last evening to call Krivoy Rog and to consult with the managers. And I can now predict with complete confidence how that came out."

"So you reconsidered it?"

"Yes," confirmed Bakun.

"And you will require that we return the shipment to you in its entirety?"

The representative again shook his head in agreement.

"Well, there you have it," commented V. Golgalyuk. "The method is known. The combine's management, certainly, knows that we are tight on metal, and it plays on that fact. If we agree to return the rejected shipment in its entirety, then we will have to somehow obtain the railroad cars, and this is not easy. You can check on that. Then we have to ship the metal and wait for two or three months for a new shipment. We cannot do that, because along with our plant there would be a stoppage in the assembly lines of the ZAZ and other plants in our country. And that's why we accept somebody else's rejects and reluctantly send unfit metal to production."

But we look on the situation differently. How has it usually turned out that the unsuitability which was clearly obvious in the eyes of the representatives from Gorkiy was not caught by the OTK controllers while it was still in Krivoy Rog? Was it necessary to haul the product over one thousand kilometers in order to establish that which is obvious?

A representative of the Krivorozhskiy Combine to whom I put this question only shrugged his shoulders.

"Yes, it was not returned to the sender," said V. Gongalyuk, interrupting the conversation. "There has not once been a representative from that plant's OTK here. And, excuse me, what is your specialty?"

"I am a senior repairman," answers V. Bakun. Judging from everything he really didn't like this conversation.

"This is nothing," continues V. Gongalyuk. "No only did nobody come here. Once a brigade leader from the motor transport shop was sent. And all the representatives, so to speak, promise to report on our problems immediately upon their return, and to sort things out with the organization manufacturing the rejects. And then they disappear forever. You, probably, will also so promise?" he asks Bakun.

"Certainly," Bakun warmly assured him. "I promise you this as a deputy chairman of the Committee for People's Control."

"That means that somebody else will come next time," declared Gongalyuk. "That is how it is usually done. The explanation here is simple. For the metallurgists our plant is an ordinary customer."

Yes, for the metallurgists, Krasnaya Etna is not an especially good partner. It receives just small shipments in all and requires a large assortment of types of steel. It a word, it is a lot of trouble. And the gross output demands its own considerations. But no matter how insignificant the articles for the Gorkians may seem to the metallurgists, you have to automobile production without them. The enterprises of the Ministry of Ferrous Metallurgy have to understand this in the end. It is high time for their management to consider the damage the state suffers when substandard metal is "as an exception."

9016
CSO: 1842/1

CENTRAL COMMITTEE MEETING DISCUSSES FORTHCOMING STATE INSPECTION

Early Preparation is Critical

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 19 Nov 86 p 2

[Article by S. Kolpakov, USSR Minister of Ferrous Metallurgy, under the rubric "Five-Year Plan: Reserves for Acceleration": "The First Steps are Encouraging"; text in slantlines appears as a general introduction to three related articles]

[Text] /State inspection of products will begin at a large group of enterprises as of January 1 next year. The new type of control will encompass the most important products -- nearly all agricultural tractors and combines, the overwhelming majority of televisions and refrigerators, 70 percent of automobiles, more than half the lathes.

As an experiment at 42 enterprises showed, the shift to state inspection is an extremely complex matter. Not one collective coped with it painlessly. Here and there production volume fell, production facilities had to be rebuilt, and technological discipline and the amount of instrumentation equipment and devices had to be drastically increased. But the experience gained during the experiment showed something else: these difficulties are surmountable, and the better prepared the collective, the better it copes with them.

How is preparation for the shift to state inspecting going? What kind of problems have arisen and how are they best solved. These questions were discussed at the November 14 meeting of the Party's Central Committee. Today we present the remarks of several participants./

The transfer of 40 large branch enterprises to state acceptance is an extremely critical step for us. Much more critical, I think, than for the rest. Here the problem is primarily one of specificity. Our production facility is a continuous hot conveyor. For example, about 80,000 tons of molten metal are in process every day at the Magnitogorsk Works. Even brief stoppages under these conditions are simply impermissible.

Therefore we very carefully began preparation as soon as the decision was made. First, we held directors' councils in associations and provided enterprises with required rate-fixing documentation. Then we devised a

precise monthly plan of action. For example, in July, we gathered the heads of technical departments of all 40 enterprises together with scientific-research institutes -- they discusseed their strategy and problems related to technical documentation and technology. The next month, each central plant laboratory head made a report, mostly on bottlenecks which had developed and on the plan to eliminate them. Then the heads of technical supervision departments met. On November 24 a wrap-up meeting will be held in Lipetsk, to which we are inviting all chief engineers, along with heads of state inspection services. They will have to report on the state of affairs at enterprises and on their readiness to switch to new conditions.

But reports and reality don't always correspond. Therefore, since October we have been conducting practice inspection at all 40 enterprises. What did it reveal? Four collectives completely passed the test and today are already prepared for state inspection.

At the remaining enterprises, state inspection staff members delayed shipment of 10 to 50 percent of the goods submitted to them. However, further analysis shows that complaints primarily involved packing and appearance -- so-called adjustment operations. After the required modification, all this metal went on its way.

This first experience added to our optimism. To be honest, we were worried that more serious problems related to the metal's structural and strength properties might arise. The state inspection test shows that everything was normal -- the entire output of 40 enterprises completely satisfied the main parameters in standards and specifications.

In the remaining month and a half, we are planning to concentrate major efforts in two areas: technical and social. One of the priorities is to put documentation into order. Here we are especially blameworthy. After each People's Control check, for example, there is an attempt to hammer every comment into the GOSTs. As a result, they are so clogged and cluttered that they are virtually unusable. Together with USSR Gosstandart, our specialists have already done a great deal to clean up rate-fixing documentation, and we will undoubtedly finish on time.

A more complex set of problems is related to the condition of equipment and lack of instrumentation. I won't say that these are new problems for us, but the switch to state inspection has made them much more acute, pushing them to center stage. Let's take an example. We produce pump-compressor tubes. They are to be tested at a pressure of 800 atmospheres, but equipment does not exist, either in our country or abroad, as we discovered. How can this be? We selected all the statistics and made sure that, for the 10 years that these pipes have been produced, there has not been a single complaint. On this basis we agreed that, for the time being, they would be accepted without high-pressure testing. But only for the time being -- until the required stands, which we have already ordered, are ready.

We have a tremendous need for nondestructive testing devices. We were first seriously occupied with this problem about 5 years ago, but only now are the

first practical results appearing. It seems that we will not untie this knot before January 1. What's the solution? First, naturally, intensify efforts to create the required testing equipment. And until it is available, to assume responsibility for the quality of production ourselves. If this responsibility is not to be an empty phrase, we have to drastically increase technological discipline right now and, where necessary, refine technology to guarantee stable metal parameters at the end of the line.

In my opinion, this is the strategy for switching to state inspection: quickly instill order at enterprises, improve discipline and, at the same time, devise a solution to serious problems which determine product quality. It is therefore important to understand from the very beginning that state inspection is not a campaign; it is for the long term. In other words, we must immediately deploy and properly direct people.

We must admit that this is still an untouched area of work. Of course, there are collectives, such as the Novolipetsk Works, which has asked to begin state inspection early -- as of November 14 -- correctly gauging that it is better to suffer this remaining month and a half than suffer later, as of January 1. But most enterprises, unfortunately, are not rushing into battle. We recognize how important and decisive a role the human factor plays in these conditions. Specifically, we are preparing to revise wages and bonuses to interest people in high quality and thus place organizational and educational work done in collectives on a material base. I am sure that these efforts will bring results in the near future.

Good Relations with Plant Workers Needed

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 19 Nov 86 p 2

[Article by S. Kurhsev, head of State Inspection at the KamAZ Association, under the rubric "Five-Year Plan: Reserves for Acceleration": "Not 'Over,' but 'With'"]

[Text] We state inspection workers are sometimes considered almost enemies. They say, "They've been set over a collective and told to correct some of its troubles." This is simply a fallacy, and a very harmful fallacy. Judge for yourselves: KamAZ is made up of 11 plants where tens of thousands of people work. They produce millions of rubles of product. Can we remain indifferent to the affairs of this huge collective, dispassionately recording its successes and failures? No, of course, not. Most important, our task is not "to delay rather than release," as some imagine. Our task is to help the collective achieve the highest level of quality. This can be done only by acting in a united front with production workers.

Here, in my opinion, is the most critical difficulty in the work of the state inspection staff: neither to lose sight of the principle, nor slip into the swamp of empty formalism. We are trying to build our relations with the truck builders from this point of view.

Together with the association's engineers, our staff members have analyzed complaints from vehicle fleet operators and set priorities. The program "KamAZ -- Quality" was based on this during preparation for state inspection. It calls for production of scarce tooling and instrumentation and improvement in the technological accuracy of equipment. The Quality Service has already been reorganized -- it is no longer subordinate to the directors of plants which make up the association.

In this way solid business contact has been established. But there are several points where our positions diverge. This pertains primarily to deadlines for reaching the work level in terms of decisive indicators such as vehicle service life and fuel economy. The truck builders postponed them to the end of the five-year plan -- several items even longer. We immediately stated our categorical disagreement with these plans and stressed that we would entertain no compromises.

We still do not agree on the rates at which people's attitudes are changing. We state inspection workers believe that these rates are not high enough. Certain collectives still maintain the attitude that state inspection is a campaign. Many do not understand its essence, its character. In conversations with workers, I clearly sense the stress they are now under. People are keenly aware that future changes may affect each person. They are acutely interested in what specifically this will mean, what economic sanctions will be used, let's say, on those who permit defective products or violate technology.

In our opinion, the answers to these questions must be given immediately. And not only in words, but in a specific economic mechanism. This directly determines the level of the collective's readiness to switch to state inspection. Analysis has shown that about 12 percent of technological operations today are performed with violations. And in most cases at the fault of the operators themselves. This means, if we make clarifications now and reinforce them with the instrument of material incentive, we can immediately, without any material expenditure, achieve a drastic improvement.

I also want to touch on certain problems related to the formation of the state inspection collective. We have probably the largest in the country -- and the amount of work is huge. But all this is on the level of assumptions; we do not know our specific size.

Another important item. We recruit primarily from KamAZ specialists. This is natural. We basically need qualified truck builders who thoroughly know their business. But it is not natural that we cannot answer the whole range of questions people inevitably have. For example: Are the benefits a worker had at his own enterprise retained in the switch? How will night work be paid? Can he count on additional vacation and pay for hazaradous working conditions, etc.?

All these questions are far from idle. The kind of specialists who will work for us greatly depends on their answer.

We, of course, are trying to find internal solutions to these problems. Not

without loss, but so far we are managing. One in every three workers is now a communist. We intend to maintain this level in the future. This means that we will soon have a rather large party organization. But here again, the complex problem of its subordination arises. It seems to us that, for the good of business, it would be proper to establish an independent party organization in the state inspection collective and to subordinate it directly to the CPSU gorkom.

Dont' Eliminate Technical Supervision

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 19 Nov 86 p 2

[Article by M. Agayev, general director of the "Bakelektrobytpribor" Association: "If We Look at it Realistically"]

[Text] To be honest, it is always hard for me to imaging what would happen if state inspection had come, not now, but several years ago. The situation without it then was dramatic. Refrigerators were returned to our plant by the carload. We couldn't even manage to disassemble them to install good parts and assemblies. The enterprise worked at a loss, and it seemed that there were simply no solutions.

But one must begin somewhere. We decided to redesign the refrigerator. We refused to reinvent the wheel. Without evasion, we took the Minsk model and reproduced it ourselves, one-to-one, and thus eliminated many problems of technology. The people at Minsk helped us with tooling. In a word, things moved, but not far.

We began to make new, good refrigerators. The brand name on them was our old one, well-known to the customer. And the customer didn't believe us -- he rejected us. This was one of the most difficult and embarrassing moments in the collective's life. How to get across the ability of people who had just mastered themselves and learned to make a good product, when it didn't move farther than the warehouse?

We found a way out, however. We began to export our refrigerators where our past deeds were unknown. In 1983, we shipped 40,000 refrigerators abroad; the next year, 140,000; last year, 150,000; this year, 154,000. Through export we regained our reputation in this country. Throughout the entire time the plant has existed, we had never reached design capacity. But last year we did -- we made 330,000 refrigerators.

I have told this story to assure the doubters, to show once again that there are no hopeless situations. I think that there are few enterprises in this country that have failed as completely with quality as we. But we came out of it, which means it is possible.

Then the collective became completely different. These are people who believe in their own strengths, take pride in the factory brand name, and suffer for the common cause. They have the broad shoulder for the task.

We are now beginning a major reconstruction. The goal: to completely

rebuild the lead plant and update product in two years, without shutting down production, without reducing the rate of production growth. By the end of the five-year plan, we intend that 90 percent of product match the world level. I think everyone understands in what a complex situation we have put ourselves. But, in the collective, we have not simply understanding, but total support.

This why the appearance of state inspection representatives has caused us no special concern. Of course, not everything goes smoothly, and even now there are still certain problems, but they are being solved. In October, we submitted 38 percent of our product for state inspection; this month we should release 60-65 percent; in December, all 100 percent. In this we have no doubts whatsoever.

But here's a problem that arose in connection to this. We have had to listen to the opinion (and voices have been raised even here at the enterprise): since there will now be state inspection, let's shrink the technical supervision department apparatus and shift this money to other subdivisions. I believe that this is an absolutely incorrect way to state the problem. We fought so hard to strengthen the technical supervision service. And what happened? The average salary of a technical supervision worker is 145 rubles, but alongside, that of the production worker is 200. Of course, everyone knows who became inspectors.

Only just recently we managed to correct the situation. By redistributing assets within the salary fund, we made the inspectors' salary nearly 200 rubles. Moreover, we introduced a procedure whereby anyone from basic production who wants to can switch to the technical supervision department and keep his average wage. As a result, we filled the technical supervision service with qualified personnel. It began to work efficiently and competently. Are we to destroy all this now? No, I think that state inspection should help us. For this I'm grateful. But the responsibility for production was and still is with the enterprise. And this is impossible without a strong technical supervision department.

12809
CSO: 1842/20

- END -

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, economic, military, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available source; it should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated. Those from English-language sources are transcribed, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names which are rendered phonetically or transliterated by FBIS/JPRS are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in 8 volumes: China, East Europe, Soviet Union, East Asia, Near East & South Asia, Africa (Sub-Sahara), Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications generally contain less time-sensitive information and are published periodically. Current JPRS publications are listed in *Government Reports Announcements* issued semi-monthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcovers or microfiche) at no charge through their sponsoring organizations. DOD consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.) For additional information or assistance, call FBIS, (703) 527-2368, or write to P.O. Box 2604, Washington, D.C. 20013.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. New subscribers should expect a 30-day delay in receipt of the first issue.

Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.